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ILLINOIS BIOLOGICAL MONOGRAPHS

VOLUME XIII

PUBLISHED BY THE UNIVERSITY OF ILLINOIS

URBANA, ILLINOIS

EDITORIAL COMMITTEE

JOHN THEODORE BUCHHOLZ
FRED WILBUR TANNER
CHARLES ZELENY, Chairman

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JOHN THEODORE BUCHHOLZ FRED WILBUR TANNER
CHARLES ZELENY

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A MONOGRAPHIC REARRANGEMENT OF LOPHODERMIUM

WITH FIVE PLATES

BY

LEO ROY TEHON

CONTRIBUTION FROM THE BOTANICAL LABORATORY OF THE UNIVERSITY OF ILLINOIS

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INTRODUCTION

Fungi of the genus Lophodermium are of interest from two primary points of view. First, since many species inhabit leaves of evergreen trees and either cause or are closely associated with premature falling of the needles, they have been the subject of much investigation as factors concerned with economic destruction. Second, because of their heterogeneity of morphological characters, species of the genus have within recent years come to have a very uncertain position in the system of mycological taxonomy.

It is not the purpose of this paper to undertake a discussion of the economic aspects of the genus. Several investigators, notably von Tubeuf (1888, '95, 1901, '08, '10)* in Europe and Darker (1932) in America, have brought together this information so far as the conifer-inhabiting species are concerned. Of those species that inhabit grasses, probably none is economically important; and this is true also of the species that inhabit other monocotyledons and the dicotyledons. It is characteristic of species on all plants other than conifers that their fructifications either are not developed until the life of their host is ended or are developed only just before or sometime after the leaves of dicotyledonous hosts have fallen. Since the number of species on coniferous hosts is smaller than the number on monocotyledons and dicotyledons, and since even among those on conifers some are recognized as saprophytic while for others there is often very little proof of pathogenicity, the genus is to be regarded as made up of a preponderance of saprophytic forms.

The taxonomic relations of Lophodermium, with which this paper is especially intended to deal, have not been well investigated. The Hysteriales, to which Lophodermium has been assigned, have been given so little attention that Gäumann, in his "Comparative Morphology of Fungi" (1928), has been able to give only a page and a half of discussion to the entire order. According to this authority the Hysteriales are Pyrenomycetes with elongated perithecia which are closed during development and which open at maturity by means of a long slit that follows an earlier developed dehiscence line. Characteristically, the hymenium is completely uncovered at maturity.

The elongate opening is a character possessed also by the Lophiostomataceae of the Sphaeriales; and it is the opinion of von Höhnel (1918) that on this account these two groups should be united in an Order to which he has given the name Hysterostomeae. In this treatment, the ma-

*Year numbers, with or without parentheses, following an author's name refer to articles listed under his name in the Supplementary Bibliography (p. 124).

jority of the Hypodermataceae are, however, removed to the Phacidiales (in von Höhnel's sense, strictly) and are there redistributed in a number of new families.

In both views, the taxonomic position of Lophodermium is determined on the basis of such simple characters as the fact that the fructifications are imbedded in the host tissue, that they are elongated, and that they open by a longitudinal slit. Neither the morphology nor the ontogeny of the genus (nor, indeed, of the order) has been sufficiently investigated to give any adequate basis for a satisfactory placement of the heterogeneous forms included in it.

As a basis for the treatment given in the following pages additional facts will be presented, bearing upon the morphology of the hysterothecium. It has, however, been impossible with the material at hand, to add to or to substantiate the meagre information already furnished by Killian and Likhité (1924) and by Likhité (1926) on the ontogeny of the genus. This is a field in which further investigation would be very well repaid.

Among the named species of Lophodermium a large proportion are represented by a very small number of collected examples—many, in fact, only by the type specimens. These are often difficult to secure, because types have not been preserved, because the place of preservation has not been recorded, or because of disorganized conditions in the herbaria in which they are kept. The following is a list of such species, which are necessarily omitted from consideration in the body of this paper.

1. Bolivarii Frag.
2. Calami Henn. & Nym.
3. Canangae Henn. & Nym.
4. cedrinum Maire
5. Clithris Starb.
6. Empetri Rostrup, in litt.
7. Epimedii (Ces.) Sacc.
8. Gentianae Vogl.
9. intermissum Starb.
10. iridicolum Petrak.
11. Luzulae Hazsl.
12. montanum Ferraris
13. Neesii Duby
14. Oxycocci (Fries) Karst.
15. proximellum Mout.
16. Sacchari Lyon
17. sphaerioides (deAlb. & Schw.) Duby
18. Spiraeae Hazsl.
19. Theobromae Pat.
20. tjibodense Henn. & Nym.
21. tumidulum Sacc.
22. velatum Berk.
23. Vrieseae Rehm

HISTORICAL REVIEW

Lophodermium was established as a genus in 1826 by F. F. Chevallier (1826) in his "Flore général des environs de Paris." In classifying the fungi of his vicinity he divided them into 14 classes. The twelfth of these he named Cheilomyci, and in this he included a single order to which he gave the name Hysterineae. There were included in the order four genera: Lophium Fries, Hysterium Tode, Lophodermium Chevallier,

and Schizoderma Chevallier, not Ehrenberg.

As a characterization of the class Cheilomyci, Chevallier gives the following:

Fungi Sclerotiaceis *epiphytis et* Phacomyceis *quodam modo intermedii plerumque epidermide arborum corticis et plantarum erumpentes, coriacei compacti demum saepe excavati friabiles, disco bilabiato insigniti, labiis plus minusve tumidulis sulcoque longitudinali simplici aut crista prominente mediantibus. Asci erecti adfixi in pluribus paraphysophori; sporulae minutae subglobosae nec didymae.*

By way of further definition, he gives the following characterization of the order Hysterineae:

Species simplices bilabiatae ut plurimum hypogenae coriaceae nigra intus albidae, structura firma compacta solida, cunctae prima aetate dimidiatae hiantes, nonnullae quoad formam regulares, ceterae tandem confluenti difformes in plagas rugosas congestae. Asci erecti adfixi paraphysophori; sporulae subglobosae uniseriales.

As has been pointed out by Bisby (1923), this change in classification came at the time when microscopical examination was beginning to have a place in the study of fungi, but internal microscopic characters were as yet almost unknown. As a consequence, the characterization of this genus, as of all other genera then recognized, was based largely upon macroscopic characters. It is noteworthy that, so far as internal characteristics are concerned, Chevallier's descriptions do not go farther than to state that there are present 'erect asci fixed among paraphyses' and that the spores are 'minute, subglobose, undivided, and uniseriate.'

Chevallier appears to have followed the treatment of Fries (1823) in the delineation of Lophium and Hysterium; but in describing both Lophodermium and Schizoderma he is much less specific concerning internal structure. For Lophodermium he gives the following description:

Perithecium innato-prominulum solidum epidermide concretum nigrum, rima longitudinali suboblitterata aut in cristam degenerante. Asci erecti fixi. Species epiphytae Phacidiorum consortes.

while for Schizoderma no mention is made of either asci or spores.

With the present point of view, it is impossible to identify any except type material with complete assurance that it coincides with the original description. Nine species were included in Chevallier's treatment. Most of these have been removed since to other genera. But in the case of the first named species, *L. arundinaceum,* sufficient citations were given to make it possible to trace the history of the genus and its species previous to the time of Chevallier. It is, however, impossible to establish the species upon the modern basis of a historically accurate type specimen. The characterization as given by Chevallier follows:

L. arundinaceum N. parvum ovale vix prominulum submaculaeforme atrum, rima conspicua. Schrad. Journ. Bot. 2, t. 3, fig. 3. Fries. Syst. mycol. 2, p. 590.

Moug. et Nestl. Stirp. Crypt. no. 655. Hypoderma arundinaceum. D.C. Fl. fr. suppl. no. 825.

On trouve cette espece sur les tiges seches de l'Arundo phragmites. Ses peritheciums sont nombreus, ordinairement distincts, a peine proeminens, sous forme de petites taches, noires, pourvues d'une fente lineaire.

It is noteworthy that this segregation was actually the third to involve this species. It was described originally by Schrader in 1799 as Hysterium; but De Candolle in 1815 established the genus Hypoderma for subepidermal Hysteria and transferred to it this and four other species of Hysterium. Rebentisch (1804, p. 342) transferred the species again to Xyloma. But Fries in 1823 did not recognize the segregation proposed by De Candolle and returned all species to Hysterium. Chevallier, in 1822, had published his *"Essai sur les Hypoxylons Lichenoides"* and, in this, had revived De Candolle's genus Hypoderma but had, at the same time, removed from it three species, among the three, *H. arundinaceum,* which he transferred to his new genus Lophoderma. In 1826 he redescribed this genus, spelling the name on this occasion Lophodermium; and from this publication date the genus is commonly said to have been established.

The first species named by Chevallier is *L. arundinaceum,* which is therefore to be regarded as the type species of the genus. The other species included in Lophodermium by Chevallier were *L. gramineum, L. nervisequium, L. pinastri, L. petiolare, L. scirpinum, L. Rubi, L. herbarum,* and *L. xylomoides.* Certain of these have since been segregated into newer genera.

In his definition of Lophodermium Chevallier appears to have taken into account only macroscopic characters, with the single exception of the statement *"asci erecti fixi."* His description of the including order requires paraphyses and minute, subglobose, undivided spores,—characters repeated for the genera Lophium and Hysterium but not for Schizoderma. It might be assumed that similar characters would be expected in Lophodermium, unless the omission of a definite statement is to be taken as acknowledgment of Chevallier's probable failure to see and understand these structures. It is, at least, evident that in his treatment of the other genera he followed faithfully the characterizations given by Fries.

This point, however, was cleared up by De Notaris (1847). He defined Lophodermium on the present basis, as having filiform spores, and transferred to his revived De Candollian genus Hypoderma such of Chevallier's species as did not possess spores of this type. With the exception of the studies of von Höhnel (1917), which are to be discussed more fully later, there have been no significant changes in the concept of the genus up to the present time. The work of Rehm (1886, 1887) and of Lindau (1896) represent merely an elaboration of species numbers,

following the definitions laid down by De Notaris. Even the most recent workers, as Hilitzer (1929) and Darker (1932), have preferred the older concept, as elaborated by Rehm and Lindau, to the newer concepts of von Höhnel, which in this case as in many others has been regarded as entirely too fragmentary and radical for practical use. Hilitzer, however, recognized the need of a new taxonomic placement of this and related genera. He also, while retaining the older concept, subdivided Lophodermium into a number of subgenera: Nervisequia, for species following the nerves of needles of coniferous hosts; Pinastriformia, for deep-seated pine-inhabiting species; Petiolicola, for the single species reported to inhabit the petioles of dicotyledonous hosts; Hysterioidea, for the large number of Hysterium-like species on the blades of leaves of dicotyledons; and Arundinacea, for the large group of species and forms inhabiting the leaves, sheaths, and stems of grasses and sedges. Certain other of the 40 species considered by Hilitzer, both on monocotyledonous and dicotyledonous hosts, were left unsegregated in these subgenera.

Darker's (1932) treatment relates only to species inhabiting conifers, and in dealing with these he has recognized, after the example of Dearness (1924), some of the more modern tendencies, such as the segregation of some species, *e.g., L. nervisequium* Chev., *L. montivaga Petrak,* into von Tubeuf's (1895) genus Hypodermella and of others into von Höhnel's (1917) genus Bifusella.

In the present treatment, these segregations have been recognized, for the reason that they at least serve to simplify Lophodermium by reducing both the number and the complexity of the array of species. While extreme forms are readily recognizable, the prime difficulty in following these changes in the practical identification of specimens is that the genera concerned have been set apart with such variations as length and shape of the spore as primary characters—characters which, in some of their manifestations, are scarcely distinguishable from the formal characters of the original genus. Nevertheless, the species treated in the body of this paper are those that have not been satisfactorily deposited in these newer genera.

MORPHOLOGY

1. General Features

Lophodermium, as has been indicated in the historical section, is an Ascomycete the asci of which are contained in an elongated ascoma such as that illustrated in Plate I, Fig. 1. This structure is immersed in the host tissue and opens by means of a median longitudinal slit. The hymenium arises on the base of the ascoma and consists of subcylindrical

asci and filamentous, unbranched paraphyses. The asci contain, as a rule, 8 hyaline, nonseptate, filamentous spores.

The Hysterothecium.—The ascoma is generally known under the name hysterothecium, a term coined by Clements (1909) in order to distinguish between ascomata of this type (which he seems to regard as elongated perithecia with correspondingly elongated ostioles) and apothecia in which the opening takes the form of irregularly radiate cracks or a complete breaking away in an irregular fashion of a larger or smaller portion of the cover.

In Lophodermium, the hysterothecium is in all typical cases longer than broad. There is, however, much variation. In some species it is very broadly oval and may approach a circular form, while in others its length is so great in proportion to its width that its general form is best described as linear. To the unaided eye hysterothecia appear as tiny black spots on the host, sometimes shiny but usually dull, and mostly less than 1 mm. long.

The shapes of the ends of the hysterothecium vary to some extent, more particularly as between species than as between representative samples of a species; and they can be described with some accuracy as being truncate, sharply or bluntly rounded, or apiculate.

Under moderate magnification (12 × for most species, up to 30 × for the tiniest) the slit can be clearly seen. It seldom extends the entire length of the hysterothecium and is bordered on each side by heavy labia, which spread apart and reveal the hymenium to varying degrees. These labia vary in distinctness, in width, in length with relation to the hysterothecium, in degree of carbonization, and in thickness. It is distinctive of them, however, that they form a definite linear structure very similar to a true ostiole; and they are to be regarded as a definite provision for the emission of spores. The hygroscopic characteristic usually attributed to them probably does not exist in most species. The split occurs, not as a result of the swelling attendant upon absorption of moisture but as a result of the normal growth and development of attendant structures. Normally the lips completely inclose the slit; but in some species, and often in old specimens, cracking of the cover along the line of the split occurs beyond the lips at one or both ends of the hysterothecium and gives the appearance of a structure less definite than is actually present.

Darker (1932) has called attention to the occurrence in some species, *e.g.*, in *L. juniperinum* and *L. pinastri*, of rows of hyaline, papillate cells along the inner edges of the lips. These he describes as dove-tailing into one another. This structure seems to have been described on the basis of a misconception. Either it forms no part of the hysterothecium proper, in which case it is merely the cuticle or epidermis of the host, or it is the dried remains of the opening mechanism.

In section, the hysterothecium appears somewhat applanate and lenticular to triangular, as illustrated in Plate I, Figs. 2 and 3. It consists of a basal layer, variable in thickness according to species, composed of pseudoparenchymatous, brown cells. Above this is a layer of hyaline plectenchyma, in which there is often a definitely evident columnar arrangement of cells. This layer also is variable in thickness, both according to species and age of specimen. Because it is the layer from which the hymenium appears to arise, it has been termed the hypothecium by Hilitzer (1929). Covering the hymenium is a layer of more or less carbonized tissue, evidently distinct at the edges from the basal layer, variable in thickness according to species, composed of pseudoparenchymatous cells thickened or carbonized so as to resemble collenchyma tissue in higher plants. Hilitzer (1929) has used the term "melenchyma" to describe this and also the thick basal tissue of certain species, but the author will use in subsequent pages the term "pseudocollenchyma" as more suitable and perhaps more accurately descriptive of the aspect of the tissue, though it will be understood that he does not imply any similarity of origin between this and the collenchyma of higher plants.

In the median region of the hysterothecial cover, a very heavy carbonization usually takes place, making it impossible, even in the thinnest sections, to distinguish clearly the cell structure; but a longitudinal band of cells, such as those shown in Plate I, Fig. 3, remains less carbonized and separates the carbonized region longitudinally into the halves which eventually form the labia of the hysterothecium.

In mature material, the lips are bordered inwardly, Plate I, Figs. 1, 2, 4, 5, by a layer of gelatinized, short filaments which are homologous with the periphyses of the Sphaeriales.

The Hymenium.—Most of the interior of the hysterothecium is occupied by the hymenium. This consists of erect, intermixed asci and paraphyses. Both the asci and the paraphyses arise from a hyaline, subhymenial plectenchyma of very fine hyphae whose intricate interweaving conceals the method of ascus formation. In most forms the paraphyses exceed the asci in length, and their overtopping portions, becoming gelatinously agglutinated, form a dense layer, readily visible through the hysterothecial slit, which has been quite generally called the epithecium. In most species the epithecium shows as a silvery white layer; but in a few species it is brilliantly tinted, the tints varying with the species and ranging from yellow to deep orange.

The hymenium arises only from the morphological base of the hysterothecium and does not, in any species examined by the writer (though it has been so described by others), extend upward along the sides, *i.e.*, the cover, of the hysterothecium.

The Ascus.—The asci, in accord with the shape of the spores, are much longer than wide. the ratio of width to length varies between species but is usually as from 1/10 to 1/15. The general shape varies from clavate to cylindrical, much variation occurring within a given species, or indeed among the asci in a single hysterothecium. It is difficult to describe the asci accurately. At the apex, they are asymmetrical, more or less conical, and rounded to subacute when viewed from one side; but a view at right angles to this reveals only a symmetrically rounded or subacute form. This is apparently due to an arrangement of the spores which is described later. In some species the asci have been described as having rostrate apices, reference being made, thereby, to the tendency of the ascus to conform closely, when wet, to the shape and arrangement of the swollen spores. The ascus is almost invariably widest at or above the middle. Below this point, according to species, and often with much variation within a single hysterothecium, its inclosing walls taper to a broad or a fine foot, leaving little or much of the basal part of the ascus unoccupied with spores. Almost uniformly, the asci contain 8 spores.

Ascospores.—The ascospores are hyaline, nonseptate, filamentous, and of practically uniform diameter throughout. Length, with some variation among species, tends to approach that of the ascus and is very great in proportion to the diameter. In many species the ascospores are incased in a conspicuous hyaline, gelatinous matrix which varies in thickness according to the species. This matrix is probably present in all species, but in those species with very narrow asci and spores it is indistinct and seems in ordinary miscroscopic mounts to be absent. Its presence can usually be demonstrated, however, by heating the slide with a little lactic acid added to the mount.

The arrangement of the ascospores within the ascus is a character that has not received much attention. Being linear, the spores reach from the apex to near the stipe of the ascus and lie parallel with each other. The term "fasciculate" has been used to designate this condition. Besides being fasciculate, the spores are arranged very definitely in pairs, as shown in Plate I, Fig. 6. Such an arrangement is what might be expected in the light of Dodge's (1931) recent investigation of ascospore formation. The individuals of each pair of spores lie parallel with each other, and the pairs are arranged in a series of four. One pair terminates just at the tip of the ascus; a second pair lies immediately to the front of the first and somewhat lower in the ascus, and the succeeding 2 pairs of the series are similarly stepped forward and downward. It is this ranked arrangement of the ascospores that gives to the ascus, in a lateral view, its asymmetrically conical apex.

In many species there is a marked tendency for the spores to be twisted or coiled in the ascus. In general, this is slight and may in fact be due to twisting of the ascus in its growth. In a few species, however, the twisting of the spores is very pronounced, as shown in Plate I, Fig. 7; and in these cases they assume intricately coiled positions with the distal and usually the basal portions nevertheless straight and definitely indicative of the pairs.

Darker (1932) has pointed out that there is little variation in length of spore due to drying, but that dessication very markedly influences spore width. Prolonged soaking in water tends to restore dried spores and asci to their natural diameter; and for quick microscopical examination the same end can be achieved by heating in a 3 per cent aqueous potassium hydroxide solution.

Paraphyses.—These structures arise in most species from a series of columnar cells which form the top of the subhymenial plectenchyma. They are hyaline, filamentous, nonseptate, and normally unbranched. In the case of many species, they have been described as coiled, bent, or hooked at the apex (Hilitzer, 1929, fig. 7). This variation in their apices appears, however, to have been subject to much misinterpretation. In the examination of many specimens of many species, I have seen no case in which the tips of the paraphyses could be accurately described as coiled. As a matter of fact such an appearance, readily misinterpreted with improperly prepared slides under low magnifications, is invariably the result of pressure against the hysterothecial cover by which the tips are irregularly bent or crushed. The degree to which the bending and crushing occurs is determined, evidently, by the position of the individual paraphysis in the hysterothecium and by the direction it is forced to take prior to the opening of the hysterothecium. The frequently described uncinate, or hooked, paraphysis tip is likewise largely the result of misinterpretation. *L. uncinatum* Darker is the only species in which I have found definitely hooked paraphysis tips, and their occurrence even in this species appears, upon careful examination, to be limited to the extreme sides of the hysterothecium, suggesting again the formative effect of pressure against the cover.

A variable, but often distinctly observable characteristic of paraphyses is that their distal ends are clavately expanded, as shown in Plate I, Fig. 6. The degree to which this occurs, or its entire absence, constitutes one of the characters, describable with difficulty, by which a species may be recognized.

2. Particular Features

In addition to these general characters of the genus, there are certain particular features of morphology that deserve special mention. According to the structures to which they appertain, they are given below.

HYSTEROTHECIUM.—In addition to the general structure described in the preceding section, true of all species hitherto classed as Lophodermia, there are certain more intimate details which will now be recognized as of exceptional importance. These include: (A) the position of the hysterothecium with respect to host tissues; (B) mycelial structure of the hysterothecium; (C) general structure of the hysterothecium; and (D) the nature of the slit.

(A) *Position in the Host Tissue.*—This character, as has been pointed out previously, is not entirely of recent recognition. Prior to the segregation of filiform-spored species, De Candole (1815) segregated in his genus Hypoderma those species of Hysterium having hysterothecia situated subepidermally. With the development by Corda (1842), De Notaris (1847), and Duby (1861) of spore characters as a means of delimiting genera, the significance of the situations of the hysterothecia with respect to the tissues of the host was over shadowed and almost entirely dropped from sight. It was not again revived until von Höhnel published his studies of the Phacidiales in 1917; and his revival of this characteristic must be attributed to the use of it by Theissen and Sydow (1915) in their monographic studies of the Phyllachoraceae. In von Höhnel's treatment, he based the division of the Phacidiales into families upon the position of the ascocarp or ascoma in the host tissue and used as characters for genera the nature of the stroma and the shape and segmentation of the spores.

For various species of Lophodermium, this procedure resulted in a segregation into entirely new families and genera. While it has generally been regarded as radically untenable, it is, in the writer's opinion, the first real contribution to the classification of Hypodermataceae and related forms since the work of Duby in 1861. Unfortunately, even recent workers have failed to see its significance, Darker (1932) recognizing this character only to the extent of employing it as a means of distinguishing species.

Within the genus Lophodermium, as understood by Rehm and Lindau, it seems characteristic of certain species that they are oriented within the host very definitely with respect to the host tissues. Certain species, *e.g.*, *L. arundinaceum* and *L. pinastri* (*sensu* Darker, 1932), the hysterothecium is definitely placed deep in the host tissue, *i.e.*, it develops and lies at maturity beneath the epidermis; other species, as *L. Piceae* (*sensu* von Höhnel) are developed within the epidermal layer, actually separating the epidermal cells in halves and occupying at maturity the space thus made; and still other species, as *L. nitens* and *L. juniperinum*, are developed beneath the cuticle of the host. For these, according to the

scheme of von Höhnel, genera have been created and these genera segregated into families, the prime characteristic of which is the location of the ascus-bearing structure.

The determination of the position of the fruiting structure in the host has been subject to misinterpretation. Whether or not the fungi concerned are parasitic, it is a fact that their presence results in much destruction of the internal tissues of their host, regardless of the position of the fruiting structures, and in many cases the only parts of the host left intact are the two epidermises. The tissues intervening are almost completely disorganized and the space is occupied by the internal mycelium of the fungus. Pressure exerted during the formation of the hysterothecium naturally tends to force the basal portion of it more or less deeply into the host, with the result that, in a superficial examination, even such species as are strictly subcuticular appear to lie below the epidermis. If carefully examined at the margins of the hysterothecia, however, where the host tissue is usually still intact, the true level of insertion can always be determined; and this can be substantiated by determining what tissues lie above or are involved in the formation or the construction of the hysterothecial cover. It is important, therefore, in determining the position of the fruiting structure, to take into account not the apparent situation of the body of the entire mature hysterothecium but the depth at which the margins of the hysterothecia are inserted and the particular tissues overlying it in the regions of the cover. The three positions of the hysterothecia of Lophodermium are illustrated in Plate I, Figs. 2, 3, and 4.

In certain of the hosts attacked by species of Lophodermium, especially Pinus, Picea, and many grasses, there exists beneath the epidermis a series of lignified cells called hypodermis. These are, morphologically, transformed mesophyll cells. Subepidermal species of Lophodermium make no distinction between hypodermal cells and other mesophyll; and there is no significance to be attached to the fact that in some species a few of these cells, either wholly or in part, become fabricated with the cover of the hysterothecium. This is illustrated especially by *L. arundinaceum,* in which the remains of hypodermal cells are to be found incorporated in both the cover and the base of the hysterothecium, when they are not completely disintegrated.

(B) *Mycelial Composition of the Hysterothecium.*—As illustrated in Plate I, Figs. 2, 3, and 4, the hysterothecium in section appears to be composed of layers of more or less carbonized, pseudoparenchymatous fungous cells. When carbonization is only partially attained, heavy darkening of the cell walls occurs at certain points only, giving an aspect very suggestive (though only on a very small scale) of the collenchyma cells encountered in higher plants (Plate I, Fig. 8). The relative thick-

ness of the pseudoparenchyma, both in the base and in the cover, though variable, may often be characteristic of a species.

Beyond this point, similarity among the groups of species ceases. Those that are subepidermal and some that are intraepidermal appear to be composed throughout of pseudoparenchymatous cells. But those that are subcuticular and some that are intraepidermal have in addition to the mass of pseudoparenchymatous cells a definite external plate, and usually also an internal plate forming the base, either composed of or resulting from the growth of aliform mycelium. These plates (see Plate I, Fig. 8) are never more than one cell thick, and form a compact layer, usually brown, chytinized only along the sides of the strands in the cover, and not chytinized in the base, and of quite variable aspect, ranging from a meandering type to radiate forms very suggestive of microthyriaceous fungi.

These aliform plates are of radial development. In the young hysterothecia a number of central cells, often not more than 2 or 3, are to be found, both in the cover and the base. From these there develop, in an outward direction, closely adjacent hyphae which branch in a more or less typically aliform or dichotomous manner as they advance. The less typical branching gives rise to the plates made up of meandering cells (Plate I, Fig. 9), while the more typically aliform branching gives rise to those plates which most nearly resemble the mycelium found in the Microthyriaceae.

The degree to which the aliform cover and basal plates are developed differs among species, and the readiness with which their presence may be determined also varies. In intraepidermal species, the entire cover, and for the most part the basal layer also, appears to consist of more or less radially arranged lines or rows of pseudoparenchymatous cells, and their aliform derivation is determinable only by examining with care their outermost, marginal cells. These will, as a rule, be found to show, in their "mitten-shaped" outlines, their aliform manner of growth. In subcuticular species, both the cover plate and the basal plate are definitely aliform and easily observable to be so throughout the hysteriothecium, except in the region occupied by the heavily carbonized lips. In some species, as *L. nitens*, the aliform cover plate often extends outward beneath the cuticle as a compact, thin skirt to a considerable distance beyond the hysteriothecial pseudoparenchyma.

Pseudoparenchyma and its subcarbonized derivative, pseudocollenchyma, are evidently developed as inward proliferations from the basal and covering aliform plates.

(C) *General Structure of the Hysterothecium.*—As has been noted, the aliform plates of the cover and base originate from centrally placed

cells, those of the cover being distinct from those of the base. The two plates develop separately; but almost *pari-passu*. In the subcuticular and intraepidermal species, the cover and base plates are distinct and separate structures, between which the pseudoparenchyma, subhymenial layer, and hymenium are subsequently developed. The hysterothecium should be regarded not as a unit structure comparable to, and derived from fundamental cells in the same manner as are, the perithecia of the Sphaeriales but rather as of the type found in the Stigmateacea of the Hemisphaeriales, from which they differ distinctly in that they possess both base and cover.

While there is no aliform structure evident in the hysterothecia of subepidermal species, there is to be seen, when careful sections are prepared, a very evident distinction between base and cover (Plate I, Figs. 2 and 10). In fact, the separation between base and cover is just as distinct, often times more so, as in those species possessing aliform structure.

(D) *Nature of the Slit.*—It has been generally supposed that in Lophodermium the hysteriothecium opens by splitting longitudinally along a thin band of subcarbonized cells lying between two narrow, heavily carbonized, much thickened lips. The band of cells along which the split occurs was recognized by von Höhnel (1917) and by Hilitzer (1929), and was named "slit band" by Darker (1932).

When the covers of immature hysterothecia are viewed microscopically with transmitted light, the slit band appears as a ribbon of cells, of varying width, lying between and much more translucent than the labia. In sections (Plate I, Fig. 3), this band appears to be made up of pseudoparenchymatous cells differing in two respects from the remainder of the cover. In the first place, they are, though brown, not to any appreciable degree carbonized. In the second, they often appear more elongate and seem to lie rather definitely in vertical rows so as to give a columnar, or palisade, arrangement.

As a result of the subsequent development of the hysterothecia, it seems evident that another characteristic of the slit band cells is that they have not lost their meristematic quality. It seems evident that, as the hysterothecium becomes mature, the opening develops, not as a result entirely of mechanical pressure, with the fissure occurring in the line marked by these weak-walled cells, but as the result of the development from this band of meristematic cells of numerous short filaments comparable in all respects to the ostiolar periphyses of the Sphaeriales. A cross section of the opening of the hysterothecium of *L. arundinaceum* is shown in Plate II, Fig. 1, with the position, relative size, and composition of these periphyses in detail.

The labia of all species of Lophodermium are lined inwardly, when

the hysterothecia are just recently opened, with a band of these periphyses. Shortly after the opening of the hysterothecium, the band of periphyses becomes more or less definitely gelatinized; and in many species it deliquesces rapidly and is lost quickly. In other species, however, *e.g., L. apiculatum,* and *L. melaleucum,* the periphyses are very persistent and, even in old and long-emptied hysterothecia, form a conspicuous silvery white crest upon the extraverted, cracked, and torn labia. In color they correspond with the epithecium, being in certain species, *e.g., L. melaleucum,* brilliantly tinted with yellow or orange.

Mycelium.—In the species of Lophodermium, as in most ascomycetes, there are few, if any, distinctive characteristics to be found in the mycelium. The parasitism of most species has been regarded as questionable, due presumably to the fact that practically all species growing on conifers and grasses, and many of those growing on dicotyledonous substrata, do not develop hysterothecia until the leaves upon which they are formed have been shed by the plant and have been upon the ground for a considerable period of time. Nevertheless, certain adaptations to host structure are evident in various classes of species.

It is noteworthy, for example, that the attack of the fungus, in nearly all cases, causes changes within the host which result in the formation of spots. These spots are usually stramineous, extensive, and irregular in shape. In graminicole species, it is characteristic that the spots, though not sharply delineated from the surrounding decomposed tissue, present a cleaner, more preserved appearance.

In the pinicole species, it is characteristic of the spots that they are sharply delimited by definite black lines, along which the needles break very easily. Those needles which are attacked at several points have the individual areas of infections sharply delimited from one another by these black lines, and under the microscope it is readily seen that the black line which separates two adjacent spots is, in fact, a double line. The limiting line of one infection is separated from the limiting line of the other infection by a small band of unoccupied host tissue. In microtome sections, these black lines are found to exist not merely on the surface of the host organ but to extend as a plate, or layer, through the entire section of the needle. They are composed of closely interwoven, often compacted, pseudoparenchymatic, carbonized strands of mycelium. The formation of the double lines by adjacent infections may perhaps be regarded as an antibiotic reaction.

In species inhabiting dicotyledonous hosts, infection spots are also, for the most part, sharply delimited by the formation of black stromatic mycelial structures. These do not, however, exhibit the same sharp antibiotic reactions that are seen in pinicole species. Adjacent spots may

merge and in subsequent development become considerably overlapped; and when the development of the fungus in one has ceased, its black delimitation will be found to have been laid down with reference only to itself, traversing the spot it overlaps and crossing, at the margin, the stomatic line of the overlapped spot.

Subepidermal species characteristically produce only internal mycelium. This is fine, hyaline, and septate, and ramifies through the host tissue, destroying particularly the mesophyll and causing collapse of the epidermal layers. There is left, then, only a leaf skeleton, composed of upper and lower epidermis and partially disintegrated veins and veinlets. This internal mycelium is very fine, usually less than 2 μ in diameter, and hyaline. About the bases of the hysterothecia it collects in closely interwoven hyaline mats resembling internal subicles (Plate I, Figs. 2 and 4), and was regarded by Miles (1926) as a part of an internal dothideaceous stromatic structure.

Subcuticular species, and occasionally others, have in addition to the internal hyaline mycelium a subcuticular or intraepidermal coarse, brown, distantly septate mycelium that is intimately connected with the covers of the hysterothecia (Plate II, Fig. 5.) When well developed, as in *L. melaleucum,* it has the appearance of a network, due to its frequent branching and the tendency of the hyphal threads to follow the lines of union of the epidermal cells. In some forms there is a tendency for this extra-hysterothecial mycelium to become aliform, that is, it often divides dichotomously, and some of the tips of the strands bear the mitten-shaped terminal cells characteristic of such mycelium. There is not, however, any indication of the presence of hyphopodia or hophopodium-like organs.

Intraepidermal species are less destructive of the host tissue. For the most part, mesophyll cells are not disintegrated; but the internal hyaline mycelium penetrates at will throughout the mesophyll, occupying both the intercellular spaces and the intracellular cavities. Material used for food by these species is evidently limited rather definitely to the material laid down by the host as secondary and tertiary thickenings of its cell walls. It is notable, also, that in these species there exists a coarser, usually brown mycelium, similar to the subcuticular mycelium of the subcuticular species, which invades and traverses the epidermal cells. It may more or less compactly fill the epidermal cells lying at the end of the hysterothecia; and when it straggles out into more distant host cells there is often an indication of its aliform nature to be found in the mitten-shaped terminations of individual hyphae.

Pycnidial Forms.—Imperfect or conidial forms have been observed in close association with the hysterothecia of Lophodermium and other hysteroid fungi by many observers. Their significance in the life history

of the fungi to which they are said to belong has been little understood. Actual connection has been difficult to prove; but their constant occurrence and obviously close connection with the hysterothecial stages seems to substantiate their relationship. They are for the most part, if not without exception, assignable to genera of the Fungi Imperfecti usually considered as members of the Leptostromataceae. Practice in designating them has varied. Rehm (1887), Lindau (1896), and others have simply included their names, when they have been named, in the synonomy of the perfect stage and have given descriptions of the spore forms as a part of the description of the species. Hilitzer (1929), on the other hand, has established new Imperfect genera and species for the Imperfect spore forms and has given their descriptions as separate entities, while designating them as the imperfect forms of the species to which they are thought to belong.

It appears that, without exception, these Imperfect forms are situated with relation to the host tissues in exact correspondence with the hysterothecia to which they are related, and their mycelial structure is also in agreement. The spores are, in most species, rod-shaped, hyaline and nonseptate; and the conidiophores are short, hyaline, and arranged in a basal layer. Dehiscence of the conidial structure appears to be irregular (though the complete morphology of the pycnidial forms has not been carefully studied); and this and the relative development of pycnidial tissue determine the generic assignment of the various forms.

Sub-stomatal Sclerotia.—In all pinicolous species of Lophodermium, and in many species inhabiting monocotyledons and dicotyledons, growth of the fungous mycelium within the host tissues is accompanied by the formation of heavy, carbonized masses of mycelium beneath stomatal openings (Plate II, Fig. 2). These structures have been variously interpreted. Hilitzer (1929) regards them, at least in part, as structures formed by the mycelium of the fungus immediately after penetration of the host. According to this view, they constitute a focus from which emanates the mycelium that makes up the individual infection. This interpretation has, as a draw-back, the fact that every spot, or colony, develops enormous numbers of these sclerotia, the number being limited, in fact, only by the number of stomata included within the area of host attacked. Killian and Likhité (1924) and Likhité (1926) regard them, at least in some cases, as the primordia within which the first process of fertilization takes place prior to the development of the hysterothecium. This may be, in part, true; but it cannot hold for all cases, else the number of hysterothecia in any infection would be so great that there would not be room for their full development.

Development of the Hysterothecium.—The period required from

the time when infection takes place until the final maturity of the hysterothecia has not been determined for many species. Those that have been followed are chiefly pinicole forms, and among them there is a very considerable variation in the time required. *Lophodermium laricinum* is known to be able to complete its development in one year (Darker, 1932), and certain species, *e.g., L. hysterioides* and *L. maculare,* which attack living leaves of deciduous dicotyledons, probably also require but one year. Most other species appear to require a longer time.

The process involved in the development of the hysterothecia, and of the asci and spores, has received less attention in this group than in any other group of ascomycetes. Killian and Likhité (1924) and Likhité (1926) have made the principal, and nearly the only, contributions.

In the case of *L. hysterioides,* a subcuticular species, it is reported that at the beginning of its development the hysterothecial stroma is strongly flattened, so that it is difficult to observe the ascogenous cells. There is in the interior of the sclerotial mass, however, one or more large, multinucleate cells with dense protoplasm which later give rise to a long chain of ascogonial cells, these numbering about 40 and having a size of 1.5–6 μ and their nuclei about 1–1.5 μ. These cells form a spiral, oriented in the plane of the stroma, *i.e.,* parallel with the surface of the leaf, and so are not readily distinguished in ordinary transverse sections.

The first cells produced—ascogonial mother cells—degenerate after the formation of the ascogonial cells, and at the same time the ascogonial cells increase in size, attaining diameters of 5 to 8 μ. This is followed by a partial absorption of the walls separating them, and it is probable, though not observed, that the nuclei migrate through these perforations to the cells at the summit of the spiral. It was observed, at least, that subsequently the summit cells of the spiral contained numerous nuclei.

Subsequently, the other cells degenerate and there appears an extensive development of hyphae which constitute the paraphyses. These arise from spherical cells with peripheral protoplasm and many nuclei. The growth of the paraphyses serves to elevate the hysterothecial cover and prepare the space necessary for the development of the asci.

Each ascogonial cell bears protuberances at its summit. Its nuclei undergo new divisions, becoming smaller and smaller. The protuberances, at the same time, elongate and become at length ascogenous hyphae; but the production of hook cells was not observed in connection with their growth.

The origin of the stroma in which these processes occur has also been described in some detail. The spore, after its germination on the lower face of the leaf, gives rise to a mycelium which enlarges little by little into a large membrane. This mycelium penetrates through stomatal open-

ings and, beneath the stomata, becomes transformed into sclerotial masses which clog the stomata. From there it spreads through the mesophyll. Much later, the substomatal sclerotia give rise to a special mycelium, more delicate than the other and very fine, which penetrates between the cuticle and the epidermis and there forms the stroma destined to become the hysterothecium.

This account by Likhité (1926) is in agreement, essentially, with the account given by Prilleux (1897) for *L. macrosporum;* but I have been unable to substantiate either account satisfactorily. It is undoubtedly true that the stomata and substomatal cavities become clogged with carbonized, sclerotia-like masses of cells (Plate II, Fig. 2); but this is true of all stomata; and the masses appear to have arisen from, rather than to have given rise to, the internal mycelium. In material available to me, it has been apparent that hysterothecia arise independently of these substomatal masses, as the result of the laying down of a few cells from which the basal and covering layers develop independently by radial or subradial growth. Even in the most carefully prepared sections, and with excellent microscopic equipment at hand, it has been impossible for me to identify with anything like certainty the ascogonial mother cells (Plate IV, Fig. 4), ascogonial spirals, or ascogenous hyphae. While some such process as that described by Likhité undoubtedly occurs, the point at which it begins, its relation to the presence of an already forming hysterothecium, and the nuclear, as well as many of the anatomical, details need much closer investigation.

TAXONOMIC RELATIONSHIPS

1. Present Status

The changes that have occurred in the classification of species of Lophodermium have been given in some detail in the historical section. Segregation of species and the grouping of them into genera, as well as the placement of the genera in families and orders, has been based from the beginning on a few superficial characters of the hysterothecium, supplemented in later years by spore shape and septation.

Fries (1823) included all species then known in Tode's genus Hysterium. Two outstanding distinctions, namely, the elliptical or elongated ascocarp and dehiscence by a simple longitudinal slit, separated this genus from others placed in the family Phacidiacei. This family was one of three constituting the order Pyrenomycetes and was distinguished by the perithecia becoming at length erumpent and by possessing an exposed or open disc. In contrast, the family Sphaeriacei was characterized as having closed perithecia perforated by an ostiole and the family Xylomacei as having obsolete asci and innate spores.

The Pyrenomycetes constituted, according to Fries' views, the second of five orders included in the second class of fungi, which he termed the Gasteromycetes. This class was intended to include bladder-like fungi composed of cells united into a form tending to become rotund and closed at first but opening either by means of a definitely formed ostiole or by irregular breaking. The Pyrenomycetes were distinguished by having bladder-like fruiting structures in the form of receptacles or chambers and spores collected in series in asci.

The concept of the Pyrenomycetes has persisted; but many subsequent modifications in classification have tended to give the term "pyrenomycete" a general rather than a specific meaning, and its use is now limited to the gross visual aspect of fungi. It does not imply the presence of any taxonomically significant anatomical character.

Chief among the modifications of Fries' original system of classification, so far as they apply to Lophodermium, are the following.

Chevallier (1826) separated hysteriaceous from phacidiaceous forms and gave his class Cheilomyci, which contained the former, equal rank with his Phacomyci, which contained the latter.

Fries (1835) brought together in a group all ascomycetes with hymenia exposed at maturity and these he designated as Discomycetes. In this group, he included the Phacidiacei of his earlier publication.

Corda (1842) proposed the order Hysteriaceae (Hysteriales in present terminology), but in contrast with Fries included in it the Phacidiacei. Corda's exceptional contribution was, however, the introduction of spore characters as criteria in delimiting genera.

De Notaris (1847) developed the use of spore characters to a still greater extent, dividing the Hysteriacei into Phaeosporii and Hyalosporii on the basis of spore color.

Duby (1861), while still regarding the Hysterineae as a group belonging to the Pyrenomycetes, made a primary separation on the shape of the ascomata, naming those which possess erect, laterally compressed receptacles Lophiees and those which possess flattened receptacles Hysteriees.

Rehm (1886), in his revision of the Hysteriales in the Duby herbarium, and later (1887) in Rabenhorst's Kryptogamen-Flora, brought forward the classification that has received general acceptance, even by such recent students as Hilitzer (1929) and Darker (1932). He regarded the group as a distinct order and considered it as forming a connection between the Pyrenomycetes and the Discomycetes. Toward the first, relationship was held to be shown especially by the elongated opening of the fruiting structure, the connection being with the Lophiostomeae, while toward the second, relationship was held to lie in the elongated form of

the ascoma and the apothecium-like method of dehiscence, which appears to have been regarded merely as mechanical breaking.

Lindau (1896) brought Rehm's system into conformity with modern terminology and united Rhem's distinctions between genera with those developed by Spegazzini (1880) and Saccardo (1883) on the basis of spore characters into the present system of classification.

Throughout the work of these mycologists, there has been a persistent tendency to regard the gross form of the mature hysterothecium as the criterion upon which the interpretation of taxonomic relationship should be based. The individual characters to which taxonomic significance has been attributed may be cataloged as follows:

(1) *Spores are borne in asci.* This is of general significance only, and places species as ascomycetes.

(2) *Asci are contained in a receptacle.* This also is of general significance, placing species among the large group of Euascomycetes having definitely constructed ascus containers.

(3) *The asci are grouped, erect, among paraphyses, in a well-defined layer termed the hymenium.* This serves to distinguish these fungi from those having the asci placed in various positions, as in the Aspergillales and Myriangiales.

(4) *The hymenium forms a basal disc in the receptacle.* This character is interpreted as showing relationship with Discomycetes.

(5) *The receptacle, closed at first, opens eventually by mechanical breakage.* This has been held to be a primitive combination, indicating relationship with phacidiaceous forms.

(6) *The opening of the hysterothecium is a longitudinal slit bordered by thick labia.* In this character, similarity with the complete perithecia of the Lophiostomataceae, which have elongated, laterally compressed ostioles, is observed. Progression toward, or relationship with, the Sphaeriales is thought to be indicated.

In their sum, these considerations lead to the expression by Gäumann (1928, Dodge's translation): "With the Hysteriales begins the group of hemiangiocarpous Ascomycetes; they are Pyrenomycetes with elongate perithecia, closed during development, opening at maturity by a long slit which follows an earlier dehiscence line and almost completely uncovering the hymenium."

At present, the order Hysteriales is constituted of five families. These are grouped primarily according to the connection that exists between the ascocarp and the host tissue. Two families, the Hysteriaceae and Acrospermaceae, develop their ascocarps free of the host tissue. Three families, the Hypodermataceae, Dichenaceae, and Ostropaceae, develop ascocarps which are at first immersed in the host tissue but which become erumpent. The Hypodermataceae are distinguished, in their turn, by having the walls of the ascocarps connate with the host tissue.

Within the Hypodermataceae, Lophodermium is at present set apart as a genus almost entirely upon ascus and spore characters. These are (1) asci that are essentially cylindrical in shape, rather than clavate, and

(2) ascospores that are 1-celled, filiform, and essentially of uniform diameter.

In contrast with the line of taxonomic development just summarized, von Höhnel (1918) has proposed that certain genera now included in the Lophiostomataceae and many genera of the Hysteriales should, because of the elongated perithecial opening common to both, be united in a new order, for which he has proposed the name Hysterostomeae. This does not, however, affect any species of Lophodermium. Prior to this (1917), however, he brought together certain genera of the Phacidiaceae and of the Hypodermataceae, including a number of species of Lophodermium, and constructed from them the skeleton of an order which he designated the Phacidiales. This name must be taken in a sense much different from its usual interpretation, for von Höhnel states that he considers it a connecting order between the Dothidiales and the Pezizales.

Within this order, according to von Höhnel's conception, families are distinguished by a single character, namely, the position of the ascocarp with respect to the host tissues. When the ascocarp is entirely external, *i.e.*, seated on the cuticle, membership in the Schizothyrieen is indicated; when it is situated between cuticle and epidermis, membership is in the Leptopeltineen; when within the epidermis, membership is in the Dermopeltineen; and when beneath the epidermis or deeper in the host tissue, in the Phacidiaceen. Further distinctions are made that do not involve any species of Lophodermium.

Within each of these families, genera are distinguished primarily upon the presence or absence of a stroma, secondarily upon spore form and septation, and finally upon the type of opening exhibited by the ascocarp.

The species of Lophodermium, though usually considered to be united by the common absence of a stroma, by the possession of filiform, nonseptate spores, and by an elongated hysterothecial opening, fall among three of von Höhnel's families, according to their position with relation to the host tissues. *Lophodermium arundinaceum* is a member of the Phacidiaceen; and, since it is the type species and retains the generic name, new genera are named by von Höhnel to contain the species falling in other families. The intraepidermal *Lophodermium hysterioides* is renamed *Lophodermellina hysterioides* in the Dermopeltineen, and the subcuticular *Lophodermium melaleucum* is renamed *Lophodermina melaleuca* in the Leptopeltineen.

The treatment given by von Höhnel was limited to exemplary species, and the majority of species included in Lophodermium have never been transferred, formally, to the positions they would occupy in his system.

In this rearrangement there is the advantage that the level of insertion of the ascocarp in the host tissues has been given consideration. Clements

and Shear (1931) recognize that the general position of the ascocarp with relation to the host tissue, *i.e.*, whether it is innate or superficial, affords a criterion of generic significance; but at the same time they express the opinion that to regard relative depth of insertion as equally important is to assume an extreme view. Admittedly, there is at present no means of weighing the relative values of criteria. But it would seem that the criterion of depth of insertion, if found reliable with regard to individual species in a large and heterogeneous genus, would furnish a satisfactorily practical method for grouping the species either into a number of genera or subgenera. To argue concerning the rank properly due such a criterion serves only to add confusion. The writer holds the opinion that, in systematizing the species of Lophodermium, the best separation can be made at the present time on a generic basis, as this criterion does not run completely parallel with either host relations or other lesser anatomical criteria.

2. New Taxonomic Factors

As a result of the development of microscopical equipment and technique, it would seem that a more satisfactory anatomical basis for classification than that outlined above might have been obtained; but the most recent students (Hilitzer, 1929; Darker, 1932), however much they may have observed, have deemed it desirable to present their work in the taxonomic pattern now accepted.

It is the writer's intention, therefore, to present here in a rather brief way such results of his studies as tend to suggest a basis for a more serviceable classification, when amplified to include other genera.

The Hysterothecium.—As is evident from the foregoing discussion, this structure has been regarded by various workers as either an apothecium or a perithecium. The term hysterothecium merely takes cognizance of the shape of the structure. Both of these views involve the basic idea that it is a unit structure; that is to say, if it is regarded as an apothecium its outer walls are, in ontogeny and at maturity, continuous from the middle of the base to the middle of the top, or if it is regarded as a perithecium the same conception of its structure must be admitted with the exception that the opening is to be regarded as a definitely developed ostiole rather than the result of mechanical stresses.

Vertical sections of hysterothecia, when taken either in longitudinal or transverse directions, do not support the conception of a hysterothecium as a unit structure. Instead, it is evident that a hysterothecium consists of two separate, distinct, and independently though simultaneously developed parts, the base and the cover.

In the case of *Lophodermium arundinaceum,* the type species of the genus, which is inserted subepidermally in its host, the separation between base and cover is very distinct. A longitudinal section taken near the middle of a mature hysterothecium is shown diagrammatically in Plate I, Fig. 10. The material from which the section was made is Mougeton et Nestler, *Stirp. Crypt. No. 655,* cited by both Fries (1823) and Chevallier (1826). At the two ends of the section, where continuity of tissue would be expected if the hysterothecium were a unit, an open gap appears between the two strata of pseudoparenchyma that form the cover and the base, and the gap is filled more or less completely by the same fine, hyaline plectenchyma that gives rise to the hymenium.

Nearly the same condition is apparent in Plate I, Fig. 2, in which a detailed cross section taken near the middle of a hysterothecium of the same species is shown. Here, however, the basal pseudoparenchyma extends outward at the margins and forms a flat rim upon which the edges of the cover rest.

Even under very high magnification, no connection between the two strata can be discerned; and the microscopical evidence is supported by the ease with which the cover can be removed intact from the base after material has been macerated chemically in a sodium hydroxide solution to loosen the host tissues.

In *Lophodermium pinastri* (*L. Piceae* von Höhnel) on Picea, a species uniformly developed within the epidermal zone, a similar independence of cover and base exists. Plate I, Fig. 3, shows a cross section taken from near the middle of an immature hysterothecium. The base had not yet become carbonized, but the cover appears to be fully carbonized. In the diagrammatic drawing, it appears that the cover extends outward, beyond the base, forming an inclosing lid.

The manner in which the two layers, cover and base, become differentiated, is shown in Plate II, Fig. 3. This figure is drawn from the margin, under oil immersion, of the same section shown in Plate I, Fig. 3. At the left of the figure, the epidermal cells of the host are filled with hyphal cells composing the hysterothecial margin. It should be noted that in each host cell there are just two rows, one above the other, of fungous cells. At the margins of young hysterothecia, these are compactly placed. But this compactness extends inward from the hysterothecial margin through only 2 or 3 epidermal cells. From that point inward, the two rows of cells begin to be separated, apparently forcibly by the elongation, vertically, of certain upper cells, which grow downward in the form of suspensors or props and raise the cover layer, providing room for the development of the hypothecium and hymenium.

In those species that are inserted between the cuticle and the epidermis, the top and the base are also distinct structures. Plate I, Fig. 4, shows in detail a cross section taken near the middle of a mature hysterothecium of *Lophodermium maculare*. In this species, the outermost layer of cells of the cover is distinctly aliform in structure and appears to develop by radiating growth. The figure shows how the aliform layer exceeds the basal layer of pseudoparenchyma at the margins, forming a cap slightly more extensive than the base which it covers. Plate I, Fig. 5, a section taken near one end of the same hysterothecium, shows more clearly the separation that exists at the margins between base and cover. That this separation is not merely an optical one resulting from differences in depth of cell coloration is shown when careful examination is made of the marginal region in thin sections under an oil immersion lens. Plate II, Fig. 4, made with the aid of a camera lucida from the margin of such a section, indicates clearly the independence of the base and the cover. Gross proof of this is also readily found in the ease with which entire covers can be removed from entire bases, leaving the margins of both structures uninjured, by rough manipulation of the cover glass in ordinary wet microscopical mounts of subcuticular species.

Structure of the Hysterothecial Cover.—In the hysterothecia of certain species of Lophodermium there is present a type of construction that differs from the construction occurring in typical perithecia of the Sphaeriales or apothecia of the Phacidiales.

In *Venturia inaequalis,* investigated by Killian (1917), the perithecial wall is a development directly accompanying the process of fertilization and ascus development and is derived from the peripheral cells of the plectenchymatic knot formed by the cells of the helix. Growth of the perithecium results from the elongation and multiplication of these cells into a hollow sphere.

In *Cryptomyces Pteridis,* investigated also by Killian (1918), the origin of the apothecium is in small plectenchymatic hypostomatal knots. These give rise, from certain cells lying between the guard cells, to fertile hyphae which bore downward, as if parasitic, into the interior of the knot, while the knot itself thickens the cell walls on its outer surface and becomes a flat, brown, sclerotic mass. Eventual development of the apothecium from this point appears to occur as the result of a multiplication of the cells composing the sclerotic mass.

In *Lophodermium hysterioides,* investigated by Likhité (1926), the hysterothecia are said to arise as stromatic masses developed by a delicate secondary mycelium emanating from substomatal masses such as that shown in Plate II, Fig. 2. This has not been substantiable in my own

studies (see p. 36). But it has appeared that hysterothecia probably develop in the following manner from small knots of plectenchymatic cells as the result of radial growth of hyphae.

So far as may be determined from sectioned and macerated material, there occurs at points not specially determined an aggregation of fungous cells which become brown in color and from which emanate in a radial direction an upper and a lower plate of mycelial threads. These hyphae, in some species, tend to interweave and form a pseudoparenchyma, in others, to form a compact flat plate one cell thick. From the covering layer there is proliferated, on the underside, a mass of pseudoparenchyma which gives the cover its thickness, and in many species the basal layer is thickened by upward proliferation of cells.

It is characteristic, in all species in which the outermost layer of the cover forms a mycelial plate, that at the margin of the hysterothecium the terminations of the individual hyphae can be distinctly seen, both in the cover and in the base. In many species it is characteristic of the cover to spread out beyond the base at the margins at maturity and form a distinct fringe, or skirt; but in the course of the development of the hysterothecium the extent of the base often exceeds that of the cover. It is evident throughout that the hysterothecium is not formed as a result of haphazard proliferation of cells from a globular or disciform fundamental sclerotic mass. It is, instead, developed as the result of the radial growth of two layers of mycelial strands which emanate from a central point and terminate at the hysterothecial margin.

Examination of the fringe of hyphal ends forming the margins of hysterothecia reveals distinct kinds of mycelia. These may be divided into two groups, the first of which may be termed ordinary mycelium, and the second aliform mycelium. It is not possible to distinguish more than one type of ordinary mycelium, but there are three distinct types of aliform mycelium.

Ordinary mycelium is found in the covers and bases of hysterothecia of subepidermal species inhabiting gramineous hosts, and also in species inhabiting other hosts. In these species, although the general direction of development of the basal and covering layers is radial, the individual hyphae tend to run irregularly, interweaving and following, where epidermal cells are involved, the direction taken by the epidermal cells. The result of this growth, coupled with the cell proliferations which give thickness, is the formation of homogeneous pseudoparenchyma, usually heavily carbonized in the epidermal cells but taking a pseudocollenchymatous form elsewhere.

Aliform mycelium occurs abundantly in species that are intraepider-

mal or subcuticular. Its chief characteristic is that the individual hyphae develop in a very regular manner, usually by dichotomous branching of the apical cell, to produce either a continuous true dichotomy or a sympodium resulting from successive dichotomies. Growth is therefore truly radiate. The individual threads remain in the same plane and are closely applied to each other laterally so as to form a plate of mycelium one cell thick. In the cover the form of the cells is very regular, due, as shown in Plate I, Fig. 8, to the thickening of the hyphal walls along their lateral planes of contact; but in the base the regularity of the cells and hyphae is usually less evident. Proliferation of hyphal cells downward from the aliform layer of the cover and upward from aliform layer of the base accounts for the thickening of these two structures.

The commonest type of aliform mycelium is typically dichotomous. Cells constituting the margins of both the cover and the base show the apical indention, Plate II, Fig. 6, by which growth of this kind is accomplished. It is to this type of growth that reference is made in the description of species when the word aliform is used without modification.

Less common is the sympodial type of aliform mycelium shown in Plate I, Fig. 9. Its direction of growth is generally radial with respect to the hysterothecium but it shows more of a tendency to be influenced by the topography of the host tissues and to follow the directions taken by the host cells. Cells at the margins of hysterothecia made up of this type of mycelium are usually as typically indented as those in which complete dichotomy prevails, but neither the compact outer layer of the cover nor of the base have the aspect of complete dichotomy. The very limited growth of one of the branches of each dichotomy results in a marked turning and twisting of the paths of the branches that do grow and presents an aspect that is best described by the word meandering. The term meandering aliform mycelium, used subsequently in descriptions, refers to this condition.

The third type of aliform mycelium occurs only in *Lophodermium Thuyae*. This is very similar to the completely dichotomous aliform plate in general aspect, and its development is essentially radial. The difference lies in the fact that the branching does not occur as the result of dichotomous forking of the apical cells of the hyphal strands but as the result of a multiple branching of the apical cells. As shown in Plate II, Fig. 7, the branching apical cells swell outward on one side and a number of indentions occur along the swollen side. Between each of the indentions a branch of the hypha develops, and the young structure is much like the palm of a hand with short fingers attached. In the description of the species in which it occurs, this type of aliform structure is referred to as digitate.

The Hysterothecial Opening.—As stated in the section on morphology, the slit which forms the opening of the hysterothecium has several characteristics which indicate that it is a true ostiole. In the development of the cover, the outer plate of mycelium proliferates downward along a median longitudinal line an especially heavy deposit of pseudoparenchyma. In this deposit, a narrow band running lengthwise remains uncarbonized and appears to form the dehiscence line referred to by Gäumann (1928) and termed the slit band by Darker (1932). On each side of this slit band, the pseudoparenchyma tends to become carbonized, very heavily in species such as *Lophodermium arundinaceum, L. melaleucum,* and *L. maculare.*

The slit band is not, as has been supposed, merely a line of weak tissue provided to determine the place and direction of rupture when the mechanical stresses developed at maturity become sufficient to cause breakage. It is, rather, a region in which the power of growth is for a time dormant. When the hysterothecium approaches maturity, growth is resumed in this region and results in the production, on each side of the median line, of a mass of fine, usually clavate, short filaments. Because of their location, the manner in which they are produced, and their complete spacial separation from the paraphyses (see Plate I, Fig. 5) of the hymenium, they are to be regarded as homologous with the periphyses which line the ostioles of certain sphaeriaceous fungi.

The definite construction of the labia, the fact that they are continuous with each other and form a complete border about the slit band, and the development of periphyses in the slit as it opens, indicates that the slit is morphologically an ostiole.

Mycelium.—Reference was made in the section on morphology to the types of mycelium present in species having different depths of host insertion. In almost all species the mycelium, whether hyaline and internal or brown and intraepidermal or subcuticular, is made up of the usual, cylindrical hyphae generally encountered in fungi of all kinds. In a few species, this cylindrical mycelium is distinguished by the fact that, beneath the cuticle and in the epidermal cells, hyphae terminate in enlarged cells which show the same lobing that is found in the terminal cells making up the margins of the hysterothecia. Figure 8, Plate II, shows this condition in *L. Miscanthi.* It is also striking that when the spot occupied by a Lophodermium colony is delimited by the development of a black stromatic border the hyphae in the stromata terminate in the same manner. *Lophodermium melaleucum, L. hysterioides,* and *L. pinastri* on Picea all possess this kind of hyphal termination. Some other species, as *L. apiculatum,* also possess relatively superficial strands of mycelium,

made up of two to many hyphae growing parallel to each other, which wander about beneath the cuticle or within the epidermal cells; and it is characteristic of these strands that they are marked at irregular intervals by the production of dichotomously indented terminal cells.

3. Interpretation of Taxonomic Relationships

Taxonomic interpretation of the relationships of fungi ought to be based upon the ontogeny of the fungus in question, in comparison with phylogeny exemplified by the entire class. In the case of ascomycetes, particular emphasis ought to be placed upon the processes involved in fertilization and the subsequent production of asci.

In dealing with the classification of species generally assigned to Lophodermium, this procedure is not possible. Only two attempts have been made to study the cytology of the genus (Prilleux, 1897; Likhité, 1926) and too little was learned of the details of fertilization and ascus formation to afford a basis for more than a general comparison with other types.

One is left therefore to construe taxonomic relationships by means of the characters possessed by the mycelium and fruiting structure on the basis of similarity with other groups.

On this basis, the sum of all characters shows a definite relationship with the Hemisphaeriales. The most striking suggestion of this is found in the fact that the hysterothecium is made up of a basal layer and a cover which are developed independently of each other and in the end are not united into a continuous structure. *Stigmatea Robertiani,* as shown by Klebahn (1918), develops its frutification upon a membranous layer of mycelium which lies between the cuticle and the epidermis. In this fructification there is present a basal discíform plectenchyma from which the asci and paraphyses arise. The collection of asci and paraphyses and the basal plectenchyma are inclosed beneath a hemispherical cap or lid. The outer layer of this cap is a brown and chytinized plate of aliform mycelium, very similar to the meandering type found in certain species of Lophodermium. At the periphery of the cap, the aliform plate extends beyond the edge of the basal plectenchyma and rests upon the membranous mycelial layer. It ends in an irregular and erose margin. The hyphae making up the basal membrane are themselves definitely dichotomous in their branching and radiate in waves, often forming secondary centers of radiation.

The similarity in structure between this fungus and the hysterothecia of Lophodermium is evident. The cap of Stigmatea corresponds in struc-

ture to the cover of the hysterothecium, with the exception that in the former the opening is reported to be a pore due to mechanical breaking away of tissue; and the extensive basal membrane of Stigmatea corresponds quite accurately to the much less extensive hysterothecial base of Lophodermium. In both cases it appears as though the thallus, or a portion of it, arches up and begins to thicken, while an ascigerous hymenium is formed under the arch. This pycnosis forms, in both cases, structures which can be accurately called pycnothecia.

The fact, however, that in Lophodermium the development of the basal membrane is limited to the hysterothecium, while outside it the mycelium is of the ordinary kind and is immersed in the host tissue, suggests a relationship with another of the families of Hemisphaeriales, the Polystomellaceae, although in Lophodermium the individual ascocarp is not connected with the internal mycelium by a central connecting column of hyphal threads.

A striking resemblance is found also with Lembosia, in which the thyriothecia are much elongated and provided with radially constructed covers. Lembosia, however, lacks the basal prosenchymatic layer.

The manner in which the hyphal threads are applied to each other laterally in the cover and base of Lophodermium, and the type of branching that takes place in some species (those especially that present a complete dichotomy), as well as the dichotomous indentions of the terminal cells of the individual strands, present a remarkable similarity to the method of growth and appearance of the mycelial bands constituting the thallus of many members of the Trichothyriaceae.

Against these characteristics, there stands the fact that in Lophodermium, the cover partakes of the nature of a perithecium, as shown by the development of morphological periphyses within the slit by which it opens, and thereby points a connection with certain Sphaeriales, such as Gnomonia.

SYSTEMATIC AND DESCRIPTIVE TREATMENT OF SPECIES

In this arrangement only those species of Lophodermium are being considered that have not been transferred to other genera because of the possession of criteria well recognized as of generic value. The present status of species already transferred will be found in a following section (p. 112). The species treated in this section have the following general characterization.

Parasitic or saprophytic ascomycetes with subrotund, elliptical, or linear, flattened ascocarps situated within the tissue of the host and composed of radially constructed basal and covering strata which are separate at the margins; the cover opening by an elongated ostiole surrounded by thickened or carbonized labia and lined with periphyses; the hymenium basal, arising from a closely interwoven plectenchyma of fine hyphae and consisting of both asci and paraphyses; paraphyses filamentous, simple, of uniform diameter or clavately expanded at the tips, often gelatinously united into a compact epithecium above the asci; asci cylindrical, asymmetrically rounded at the top, 4- or 8-spored; ascospores hyaline or dilutely colored, filiform, non-septate, of essentially uniform diameter throughout their length, fasciculate and arranged in pairs, frequently incased in gelatinous sheaths; mycelium internal, hyaline or brown, cylindrical, variably septate, often aliform.

KEY TO GENERA

Hysterothecia entirely pseudoparenchymatic; aliform mycelium absent from the cover and base:
- Hysterothecia subepidermal.....1. Lophodermium
- Hysterothecia intraepidermal.....2. Dermascia

Hysterothecia with a chitinized aliform plate forming the outer layer of the cover and the bottom layer of the base:
- Hysterothecia intraepidermal.....3. Lophodermellina
- Hysterothecia subcuticular.....4. Lophodermina

1. LOPHODERMIUM Chevallier

Flore général des environs de Paris, vol. 1, p. 435. 1826.

Lophoderma Chevallier, Journ. de Physique 94 :31. 1822.
Aporia Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 51. 1861, in part.
Scolecodothis Miles, Mycologia 18 : 165. 1926.

Hysterothecia dull black, subrotund to linear, subepidermal in origin and insertion, often involving the epidermal cells in the cover, made up of interwoven cylindrical hyphae which are radially disposed and form independent basal and covering layers; opening a longitudinal, periphysate ostiole; hymenium basal, arising from a closely interwoven plectenchyma of fine hyphae; paraphyses filamentous, hyaline to dilutely colored, simple, indeterminate, united or not into an epithecium; asci cylindrical to subclavate, asymmetrical at the top, 8-spored; ascospores hyaline, filiform, nonseptate, of essentially uniform diameter, fasciculate and arranged in pairs, usually inclosed in a gelatinous matrix.

Type species: *Lophodermium arundinaceum* Chevallier, Flore général des environs de Paris, vol. 1, p. 435. 1826.

KEY TO THE SPECIES OF LOPHODERMIUM

Asci generally more than 125 μ long:
  Paraphyses united above the asci in an epithecium; on Pinus.....20. L. pinicolum
  Paraphyses infrequently exceeding the asci, epithecium absent or indefinite:
    Ascospores about 100 μ long; on Picea.....7. L. crassum
    Ascospores up to 75 μ long; on Abies.....9. L. decorum
Asci generally less than 125 μ long:
  Asci generally more than 100 μ long:
    Hysterothecia large, more than 800 μ long:
      Gelatinous ascospore sheaths conspicuous; on Pinus.....10. L. durilabrum
      Sheaths not conspicuous; on Miscanthus.....18. L. Miscanthi
    Hysterothecia small, up to 800 μ long; on Convalaria.....14. L. herbarum
  Asci generally less than 100 μ long:
    Paraphyses clavately enlarged above:
      Hysterothecia large 500–1000 μ long:
        Asci 80 μ or more long; on Aira.....2. L. Airarum
        Asci not over 60 μ long; on Chamaecyparis.....6. L. Chamaecyparisii
      Hysterothecia small, seldom over 600 μ long; on Acacia.....1. L. acacicolum
    Paraphyses not clavately enlarged:
      Periphyses and epithecium tinted brown or yellow:
        Asci long and thin, 85–100 × 7–8 μ; on Mangifera.....16. L. Mangiferae
        Asci broader, 70–90 × 8–10 μ; on Ampelodesmus.....11. L. eximium
      Periphyses and epithecium white:
        Hysterothecia generally more than 750 μ long:
          Hysterothecia apiculate at the ends.....3. L. Andropogonis
          Hysterothecia not apiculate:
            Labia very conspicuous, 75–100 μ wide; on Dactylis.....8. L. Dactylis
            Labia not over 75 μ wide:
              Asci slender, about 6 μ wide; on Brachypodium....5. L. Brachypodii
              Asci broader, 8–10 μ wide:
                Ascospores 1.5–2 μ wide; on various grasses...4. L. arundinaceum
                Ascospores not over 1 μ wide:
                  Asci up to 100 μ long; on Secale.....21. L. Secalis
                  Asci not over 70 μ long; on Sieglingia.....22. L. Sieglingiae
        Hysterothecia generally less than 750 μ long:
          Periphyses persistent.....13. L. gramineum
          Periphyses soon evanescent:
            Labia narrow:
              Labia distinct, up to 35 μ wide; on Phleum.....19. L. Phlei
              Labia indistinct; on Rosthkovia.....12. L. fuegianum
            Labia 30–60 μ wide:
              Asci generally between 80 and 100 μ long, 9 μ wide;
                on Stipa.....17. L. minutum
              Asci generally less than 85 μ long:
                Ascospores 50–75 μ long; on Koeleria.....15. L. Koeleriae
                Ascospores 40–50 μ long; on Typha.....23. L. typhinum

1. *Lophodermium acacicolum* n. sp.

Hysterothecia small, dull black, amphigenous in yellow to cream colored, oval spots 1 to 3 mm. in diameter on the blades of dead leaves, few per spot, broadly oval with bluntly rounded ends and irregular, erose margins, 300–625 × 200–300 μ, subepidermal. Labia inconspicuous, car-

bonized, 30–50 μ wide, lined inwardly with greenish yellow, gelatinizing, soon evanescent, clavately expanded periphyses 1.5–2 μ wide and up to 30 μ long. Basal layer 2 to several cells thick, pseudoparenchymatous, brown, translucent, overlaid by a closely interwoven, fine plectenchyma 8–12 μ thick from which the hymenium arises. Cover well arched, entirely pseudoparenchymatic, translucent except at the carbonized margin, involving epidermal cells and in age breaking completely away. Paraphyses greenish yellow in mass, straight or flexuous, with clavately expanded tips, bent and crushed and gelatinized above the asci into a greenish yellow epithecium 15–25 μ thick, elsewhere without a gelatinous sheath, 110–130 μ long, 1–1.5 μ wide. Asci long, cylindrical, straight, bluntly and asymmetrically rounded above, tapered below into a long, fine stipe, 75–100 $\times$ 5–7 μ, 8-spored. Ascospores with a marked green tint, straight or intricately coiled near the top of the ascus, nonseptate, fasciculate and arranged in pairs, 35–75 μ long, 1–1.5 μ wide, incased in a hyaline gelatinous matrix about 1 μ thick.

Imperfect stage: Unknown.

Type locality: Wahiawa, Oahu, Hawaii.

Type specimen: Stevens, Hawaiian Fungi No. 234.

Host: *Acacia Koa:* Hawaii (Stevens, 1925).

Specimens seen: Stevens, Hawaiian Fungi No. 234, island of Oahu; No. 1156, island of Maui.

This fungus was reported by Stevens (1925) under the name *Lophodermium intermissum* Starb., but it differs from Starbach's species in important respects, aside from the fact that it is on a host belonging to the Leguminosae.

2. *Lophodermium Airarum* (Fries) Hilitzer

Hysterium culmigenum γ *Airarum* Fries, Systema Mycologicum 2 : 593. 1823.
Lophodermium Airarum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 94. 1929.

Hysterothecia scattered in poorly defined, light stramineous areas on stems, leaves, and sheaths, oriented parallel with the veins, black but not shining, oblong-ellipsoid, with obtuse or rarely mucronately terminated ends, 500–1000 $\times$ 200–500 μ, subepidermal. Labia heavily carbonized, 20–35 μ wide, up to 75 μ thick, bordered inwardly by gelatinized, early deliquescent periphyses 15–20 μ long. Basal layer of 1 or 2 layers of radiately disposed, brown, translucent, non-aliform cells, this overlaid to a depth of 10–15 μ by a hyaline, columnar plectenchyma. Cover convex and well arched, black, opaque and heavily carbonized, pseudoparenchymatic, involving epidermal cells, 20–75 μ thick. Paraphyses abundant,

filiform, straight or variously bent at the apex, 1–1.5 μ wide, 80–110 μ long, enlarged at the tips and gelatinized to form a white epithecium up to 5 μ thick. Asci cylindrical to subclavate, asymmetrically subconic at the tips, somewhat attenuated toward the base and ending in a broad foot, 80–110 $\times$ 7–9 μ, 8-spored. Spores filiform, hyaline, straight or slightly twisted within the ascus, slightly attenuated at both ends, 50–80 $\times$ 1.5 μ, inclosed in a thin, hyaline, gelatinous matrix.

Imperfect stage: Belongs to the Leptostromataceae; pycnidia about 100 μ in diameter; spores not described. (Hilitzer, *l. c.*, p. 95.)

Type locality: Valley of the Kačák River, Czechoslovakia.

Type specimen: Not designated by Hilitzer.

Host: *Deschampsia flexuosa*—Czechoslovakia (Hilitzer, 1929), Germany (Jaap, 1914), Denmark (Rostrup, 1888).

Exsiccati: Sydow, Mycotheca Germanica No. 1599.

3. *Lophodermium Andropogonis* n. sp.

Hysterothecia dull black, arranged in rows between veins in extensive, light stramineous areas on sheaths and leaves, oblong with abruptly rounded ends to linear and truncate, the ends briefly apiculate in a straggling, pointed hyphal mucron of variable size, 520–1700 $\times$ 150–210 μ, subepidermal. Labia prominent, extraverted in age, heavily carbonized, 50–70 μ wide, 25–40 μ thick, involving the epidermal cells, lined inwardly with a mass of white, clavately enlarged, gelatinizing and soon evanescent periphyses 10–15 μ long by 1.5 μ wide. Basal layer a concave plate about $\frac{3}{4}$ the width of the cover and several cells (up to 15 μ) thick, consisting of carbonized and noncarbonized pseudoparenchyma, this overlaid to a depth of 12–16 μ by a very compactly interwoven and finely constructed hyaline plectenchyma from which the hymenium arises. Cover chiefly pseudocollenchymatic, translucent and not heavily carbonized except in the labia, wider than the base, involving both epidermal and hypodermal cells. Paraphyses filamentous, hyaline, straight or flexuous, simple, not expanded at the tips but interwoven above the asci into a gelatinous, white epithecium about 10 μ thick, 95–110 μ long by 1.5–2 μ wide. Asci cylindrical, straight or curved, bluntly and asymmetrically rounded at the tips, tapered from well above the middle to a long fine stipe, 80–105 μ long, 5–7.5 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, straight or intricately coiled in the upper half of the ascus, of uniform diameter, 55–75 μ long, 0.75–1 μ wide, without evident gelatinous sheath.

Imperfect stage: Unknown.

Type locality: Peralta, Costa Rica.

Type specimen: Stevens, Fungi of Costa Rica No. 463.

Host: *Andropogon bicornis:* Costa Rica (Stevens, specimen).

4. *Lophodermium arundinaceum* (Schrader *ex* Fries) Chevallier

Plate I, Figs. 2, 7, 10; Plate II, Figs. 9, 10, 11;
Plate IV, Figs. 16, 17.

Hysterium arundinaceum Schrader, Journ. Bot. 2 : 68. 1799.
Xyloma arundinaceum Rebentisch, Prod. florae Neomarchicae, p. 342. 1804.
Hypoderma arundinaceum DeCandole, Flore française 6 : 136. 1815.
Lophoderma arundinaceum Chevallier, Journ. de Physique 94 : 31. 1822.
Hysterium arundinaceum Fries, Systema mycologicum 2 : 590. 1823.
Lophodermium arundinaceum Chevallier, Flore gén. des env. de Paris, vol. 1, p. 435. 1826.
Lophodermium arundinaceum var. *abbreviatim* Robert & Desmazières, Ann. Sci. Nat. 19 : 335. 1843.
Lophodermium arundinaceum f. *vulgare* Fuckel, Symbolae mycologicae p. 256. 1869.
Lophodermium arundinaceum f. *Phragmitis* Saccardo, Michelia 1 : 410. 1878.
Lophodermium arundinaceum var. *Piptatheri* Ranojevic, Ann. Myc. 8 : 354. 1910.

Hysterothecia dull black, scattered in light stramineous or undifferentiated areas on dead leaves, sheaths, and stems, arranged in rows between veins and oriented parallel with them, broadly elliptical with rounded ends, 575–2500 × 255–1000 μ, subepidermal. Labia prominent, heavily carbonized, narrow and of generally uniform width throughout their length, often extraverted in age, frequently cracking apart at the ends of the ostiole, lined on the inner edges with a white mass of hyaline, clavately expanded, gelatinizing, more or less persistent periphyses up to 50 μ long and about 2 μ wide. Basal layer pseudoparenchymatic, several to many cells thick, brown, more or less translucent, concave, flat at the margins and there forming a shelf which supports the cover; overlaid to a depth of 10 to 50 μ by a hyaline, closely interwoven plectenchyma of fine hyphae from which the hymenium arises. Cover well arched, pseudocollenchymatic, varying from brown and translucent to well carbonized and opaque, up to 90 μ thick. Paraphyses filamentous, hyaline, straight or flexuous, not clavately expanded at the tips but variously bent or crushed and united by gelatinization above the asci into a compact white epithecium 5 to 20 μ thick, 75–130 μ long, 1.5–2 μ wide. Asci cylindrical to subclavate, acute at the asymmetrically conical tips, tapered from the middle or below to a broad or fine short or long stipe, 70–120 μ long, 7–12 μ wide, 8-spored. Ascospores hyaline, filamentous, straight or intricately coiled, nonseptate, fasciculate and arranged in pairs, of uniform diameter, 60–100 μ long, 1.5–2 μ wide, incased in a hyaline gelatinous matrix 1–2.5 μ thick.

Imperfect stage: Leptostromella hysterioides f. *graminicolum* (de Not.) Sacc., Sylloge Fungorum 3 : 659. 1884. (Rehm, 1887).

Type locality: ? Carolina (Fries, Systema Mycologicum 2 : 591. 1822).

Type specimen: Mougeot & Nestler, *Stirp. Crypt.* No. 655. The type

material on which this species should be based would be that of Schrader, whose herbarium was deposited in the herbarium of the Imperial Botanical Garden of St. Petersburg. I am informed by Dr. B. A. Keller that it is impossible to locate Schrader's original material of this species. The first exsiccatum cited by Fries, *Scleromyceti Sueciae* No. 328, was originally published as *Dothidia asteroma* and Fries was in error in citing it under *Lophodermium arundinaceum.* Next in order is Mougeot and Nestler's specimen, cited by both Fries and Chevallier, which I have examined.

Hosts: Various grasses, of which there are the following records. *Arundinaria tecta:* Carolina (Fries, 1823); *Phragmites communis:* France (Chevallier, 1826, De Thumen, *exs.*); Czechoslovakia (Hilitzer, 1929), Germany (Rehm, 1896), Bavaria (Sydow, *exs.*), Brandenberg (Sydow, *exs.*); *Ammophila* (Calamogrostis) *arundinacea:* Saxony (Kunze *exs.*); *Nardus stricta:* Italy (Ferraris, 1902); *Piptatherum paradoxum:* Serbia (Ranojevic, 1910); *Avenastrum filifolia:* Austria (Jaap, 1916); *Arundo Donax:* Austria (Jaap, 1916); *Agropyron repens:* Austria (Jaap, 1916); *Livingstonia:* Philippines (Stevens' *mss.*)

Exsiccati: Mougeot & Nestler, Stirp. Crypt. No. 655; De Thuemen, Mycoth. univ. No. 77; Sydow, Mycoth. Germ. Nos. 1172, 1598; Kunze, Fungi sel. exs. No. 160; Rabenhorst, Fungi Europ. No. 1226. See Rehm (1896) and Hilitzer (1929) for other exsiccati.

Illustrations: Schrader, Journ. Bot. 2 : pl. 3, fig. 3, 1799; Rehm, in Rabenhorst's Krypt. Flora von Deutschl. 3 : p. 31, figs. 1-5. 1896; Richon, Catal. Champ. Marne, p. 521, 1889; Lindau, Engler & Prantl, Pflanzenfamilien 1 (1) : 269, fig. 194, k-l, 1897; de Notaris, Profilo de la famiglia degli Isteriac. pl. 6, fig. 41, 1846. Brocq-Rousseu et Gain, Ennemis de l'Avoine, pl. 12, fig. 2 a-e, 1910.

Note: The material in the copy available to us of Roumeguère's Fungi Gallici exsiccati No. 166, labeled "*Hysterium* (*Lophodermium*) *arundinaceum* Schrad." consists of two pieces of dead dicotyledonous stems, one piece apparently from a Composite the other squarish and possibly of the Labiatae. Hysterothecia typical of Lophodermina are present on both stems, subcuticular in position, distinctly aliform in cover and base, but barren of asci. The specimen is not referable to *L. arundinaceum,* but beyond that is unidentifiable.

This species, as the type of the genus, though held by Rehm (1887) to be segregated into various forms and varieties, some of which have subsequently been given specific rank, still contains a considerable heterogeneity of forms, particularly as to their host preferences. These are not easily separated from the species on constant morphological characters, or material of them has been hard to procure. It is therefore regarded

here as an inclusive species, from which further species may be segregated in the future.

5. *Lophodermium Brachypodii* Hilitzer

Plate II, Fig. 12.

Vědecké spisy vydávané Československou Akademií Zemědělskou 3 : 93. 1929.

Hysterothecia scattered in light stramineous areas of large or small extent on leaves and sheaths, narrowly elliptical to oblong with bluntly to sharply rounded ends, dull black, arranged in rows between and oriented parallel with the veins, 500–1500 × 200–500 μ, subepidermal and extending by the crushing of tissue deep into the mesophyll. Labia dark, nontranslucent, heavily carbonized, 35–80 μ wide and up to 75 μ thick, cushion like, and lined inwardly with tardily evanescent hyaline periphyses up to 20 μ long and 2 μ wide. Basal layer of brown, radiately disposed, non-aliform hyphae, 2–4 cells thick and translucent, this overlaid to a depth of 5–10 μ by a fine, hyaline, closely interwoven plectenchyma; hymenium about 90 μ thick; epithecium dull white, up to 30 μ thick, gelatinous. Cover of non-aliform and non-radiate, subcarbonized pseudocollenchymatous tissue, involving the epidermal and sometimes hypodermal cells, to 45 μ thick. Paraphyses abundant, straight or variously crushed or bent at the tips, tapered from 2 μ at the base to about 1 μ wide at the tips, up to 120 μ long, gelatinized above the asci in a white epithecium up to 30 μ thick. Asci cylindric to subclavate, tapered from near the base to a rather broad foot, obtuse and asymmetrically subconic at the tips, straight or bent by pressure, 60–90 μ long, quite uniformly 6 μ wide, 8-spored. Ascospores filiform, hyaline, subflexuous, up to 70 μ long, about 1 μ in diameter, non-septate, fascicled and arranged in pairs, without evident gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Duba, Bohemia.

Type specimen: Not designated by Hilitzer.

Hosts: *Brachypodium pinnatum:* Czechoslovakia (Hilitzer, 1929), Austria (Jaap, 1916); *Brachypodium ramosum:* Austria (Jaap, 1916).

Exsiccati: Migula, Krypt. Germ., Aust., et Helv. exs. No. 240.

Illustrations: Hilitzer, Vědecké spisy vydáv. Českol. Akad. Zeměd. 3 : 17, fig. 6. 1929.

6. *Lophodermium Chamaecyparisii* Shirai & Hara

Botanical Magazine of Tokyo 25 : 69. 1911.

Hysterothecia scattered, black, elevated, elliptical or circular, longitudinally dehiscent, 500–800 × 300–500 μ, in cross section 300–350 μ

deep, subepidermal. Asci cylindrical or clavate, obtusely pointed at the apex, 8-spored, 50–60 × 5–5.5 μ. Paraphyses filiform, slightly swollen at the apex, simple or branched. Ascospores fascicular, filiform, 40–50 × 0.5–0.7 μ, hyaline.

Type locality: Kawauye-mura, Province of Mino, Japan.

Type specimen: Not designated.

Host: *Chamaecyparis obtusa:* Japan.

Illustrations: Bot. Mag. Tokyo 25 : *pl. 2, figs. 1, 2.* 1911.

Specimens of this species have not been seen. The description above differs somewhat from the description of the authors of the species in that it includes characteristics illustrated by the drawings, as well as those in the written description.

7. *Lophodermium crassum* Darker

Contributions from the Arnold Arboretum of Harvard University 1 : 88. 1932.

Hysterothecia scattered, amphigenous, shining black, broadly elliptical to linear, 800–2650 × 550–750 μ, subepidermal, ends rounded. Cover dark, heavily carbonized, 160–180 μ thick, consisting of pseudoparenchyma and involving epidermal cells; basal layer 1 to several cells thick, made up of a loose, light brown, large-celled plectenchyma, this overlaid to a depth of 40–60 μ by a fine, hyaline, columnar plectenchyma from which the hymenium arises; aliform structure entirely lacking. Labia heavily carbonized, thick, opening widely, and lined on the inner edges by a mass of hyaline, gelatinously agglutinated and soon evanescent periphyses up to 2 μ wide and 20–30 μ long. Paraphyses filiform, hyaline, straight, the tips not enlarged or swollen but variously bent or crushed, 120–150 μ long, 1.5–2 μ wide, incased throughout their length in a thin gelatinous matrix. Asci cylindric to subclavate, asymmetrically and somewhat bluntly rounded at the tips, tapered from below the middle into a narrow base, 140–165 μ long, 9–12 μ wide, 8-spored. Ascospores filamentous, hyaline, straight or somewhat twisted with the ascus, 90–105 μ long, 1–1.5 μ wide, fasciculate and arranged in pairs, incased in a conspicuous gelatinous matrix 1–2 μ wide.

Imperfect stage: Not named. Pycnidia subepidermal, 500–1125 × 320–490 μ, opening by a longitudinal slit along one or both lateral edges, 100–175 μ deep; basal layer of brownish colored pseudoparenchyma and hyaline plectenchyma 45–90 μ thick; conidiophores simple, 15–30 μ long; conidia bacillar, hyaline, nonseptate, 4–5 × .8–1.2 μ. (Darker, *l. c.*)

Type locality: Young's Valley, Siskiyou County, California.

Type specimen: John H. Maxson, No. 797, deposited in the Arnold Arboretum Pathological Herbarium.

Host: *Picea Breweriana* S. Wats.—Type locality only.

Illustrations: Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : pl. 6, fig. 4. 1932.

8. *Lophodermium Dactylis* (Roumeguère) n. comb.

Plate II, Fig. 5.

Lophodermium arundinaceum f. *Dactyli* Roumeguère, in Fungi Gallici exsiccati No. 1700, 1881, and Rev. Mycol. 3 : 5. 1881.

Lophodermium Dactylidis Hilitzer, Vědecké spisy vydáv. Českosl. Akad. Zeměd. 3 : 92. 1929.

Hysterothecia black, oblong to oval, subepidermal, 750–1275 × 300–410 μ, subepidermal, with dark brown cylindrical hyphae meandering outward subcuticularly from the ends. Labia very heavily carbonized, 75–100 μ wide, up to 60 μ thick, lined on the inner edges with a white mass of hyaline, subclavate, gelatinously agglutinated periphyses 2 μ wide by 20–35 μ long. Basal layer 1 cell thick, of radiately disposed plectenchyma, light brown and translucent, this overlaid with a hyaline, finely composed plectenchymatic hypothecium 15–25 μ thick. Cover heavily carbonized, swollen and well rounded, composed of pseudocollenchymatic to very heavily carbonized cells involving the epidermal cells of the host, non-aliform, up to 60 μ thick. Paraphyses hyaline, filamentous, straight except at the tips which are not swollen but are often variously curved or bent and are gelatinously agglutinated into a dense white epithecium 10–30 μ thick, 85–100 × 1 μ. Asci cylindric to subclavate, 55–88 × 6–10 μ, asymmetrical and rounded to subacute at the tips, tapered below to a fine base, 8-spored. Asocospores hyaline, filiform, apparently nonseptate, fasciculate and arranged in pairs, 45–55 × 1–1.5 μ, gelatinous matrix inconspicuous.

Imperfect stage: Unknown.

Type locality: "Environs de Coulouse," France.

Type specimen: No. 1700 in C. Roumeguère, Fungi Gallici exsiccati.

Hosts: *Dactylis* sp.: France (Roumeguère, *exs.*); *D. glomerata:* Austria (Bubak, 1909), Czechoslovakia (Hilitzer, 1929).

9. *Lophodermium decorum* Darker

Contributions from the Arnold Arboretum of Harvard University 1 : 90. 1932.

Hysterothecia grayish-black, hypophyllous, arranged in 2 rows along the stomatal surfaces of the needles, short-elliptical, 500–1130 × 300–560 μ, subepidermal, 250–300 μ deep when opened. Labia inconspicuous, narrow, heavily carbonized, lined inwardly by hyaline, gelatinous, soon evanescent periphyses. Basal layer of variable thickness, consisting of a

dark brown rather tightly compacted plectenchyma tending toward a pseudoparenchymatous texture, this overlaid by a hyaline, finely constructed, closely interwoven plectenchyma 10–20 μ thick, from which the hymenium arises. Cover dark, pseudoparenchymatous, rather heavily carbonized in the central portion, involving the epidermal cells, 60–100 μ thick. Paraphyses hyaline, straight, neither enlarged, swollen or bent at the tips, immersed in a thin gelatinous matrix, 130–180 μ long and about 1 μ wide, for the most part shorter than the asci and not united above them to form an epithecium. Asci cylindric to subclavate, asymmetrically rounded at the tips, gradually tapered to a narrow base, 140–185 μ long, 16–18 μ wide, 8-spored. Ascospores hyaline, continuous, fasciculate and arranged in pairs in the ascus, long-clavate, rounded at the tops and tapered to a subacute base, 55–75 μ long, 3–4 μ wide, immersed in a gelatinous matrix 4–5 μ thick.

Imperfect stage: Unknown.

Type locality: Troy, Lincoln County, Montana.

Type specimen: Herbarium of J. S. Boyce, No. 1247.

Host: *Abies grandis:* Montana (type locality) and Oregon (vicinity of Mt. Hood) (Darker, 1932).

Specimen examined: G. D. Darker, No. 2688, Zig Zag Mt. Trail, Oregon.

Illustrations: Darker, *l. c.*, pl. 26, figs. 5-7.

This appears to be a border-line species. The spore form as illustrated by Darker and as seen in an examination of his material suggests that it might readily be assigned to Hypoderma. The absence of aliform mycelium brings it into agreement with *L. arundinaceum* so far as structure is concerned; but the spores are not filiform in the same sense. Though proportionately long, their width is still great and this, with their tapered bases, their position in the ascus and their length with relation to the ascus gives a definite suggestion of the characters expected for Hypoderma.

10. *Lophodermium durilabrum* Darker

Contributions from the Arnold Arboretum of Harvard University 1 : 87. 1932.

Hysterothecia on the outer, abaxial surfaces of reddish-brown attached needles, brownish black, elliptical, well arched, 875–1750 μ long, 375–530 μ wide, subacute at the ends, subepidermal as shown by the marginal insertion, 175–230 μ deep, occurring singly or in pairs in short sections of the leaf marked off by heavy, black, stromatic lines. Labia thick, rather heavily carbonized, 50–70 μ wide, lined inwardly at maturity by gelatinous, septate, hyaline, clavate, soon evanescent periphyses. Basal layer a very loose brown plectenchyma one to several cells thick over-

laid by a finely woven, compact hyaline plectenchyma 20–30 μ thick, from which the hymenium arises. Cover 60–75 μ thick, involving the epidermal cells and, toward the center, the hypodermal cells, consisting of poorly carbonized cells pseudoparenchymatous except in the region between the lips of young hysterothecia where they are elongated and in vertical rows and develop upon the maturity of the hysterothecium into the periphyses. Paraphyses hyaline, filiform, nonseptate, straight, clavately expanded at the tips, 100–130 μ long, about 1 μ wide, encased throughout their length in a conspicuous gelatinous matrix 1.5–2 μ thick. Asci cylindric to slenderly sub-clavate, tapered abruptly to an asymmetrically acute tip, narrowed toward the base to a fine, short stalk, 100–130 μ long, 8–10 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasiculate and arranged in pairs, 90–110 μ long, 1 μ or somewhat less in width, incased in a conspicuous gelatinous matrix 1–2 μ thick.

Imperfect stage: Unknown.

Type locality: Horsethief Meadows, Hood River County, Oregon.

Type specimen: L. N. Goodding and G. D. Darker, No. 157, in Arnold Arboretum Pathological Herbarium.

Host: *Pinus monticola:* type locality only.

Illustrations: Darker, *l. c.*, pl. 26, figs. 1-3.

11. *Lophodermium eximium* de Cesati

Rabenhorst's Fungi Europaei et extraeuropaei exsiccati No. 2643a. 1881, and Hedwigia 21 : 7. 1882.

Lophodermium Ampelodesmi de Cesati, in literature.

Hysterothecia scattered in large, irregular, stramineous spots set off from unattacked tissue by a fine, black, stromatic line 50–150 μ wide, arranged between and parallel with the veins of the sheaths, usually discrete but becoming confluent end-to-end, dull to shining black, oblong-elliptic with bluntly rounded ends and symmetrically arched cover, 525–900 μ long, 250–525 μ wide, subepidermal. Labia tending to be extroverted, heavily carbonized, and lined inwardly with a prominent and conspicuous mass of white to cream-colored periphyses. Basal layer 2 to 4 cells thick, of well browned but not carbonized pseudoparenchyma, this overlaid by a layer of closely interwoven, hyaline plectenchyma 10–20 μ thick. Cover of variable thickness, composed of partially carbonized pseudocollenchyma and involving some or all of the epidermal cells; aliform mycelium entirely absent. Paraphyses abundant, straight or somewhat flexed, exceeding the asci by as much as 20 μ and united above by gelatinization into a definite brown but thin epithecium, the tips neither swollen nor curved but usually variously bent and crushed by pressure, up to 110 μ long and usually about 1 μ or less wide. Asci cylindrical,

bluntly rounded or subacutely asymmetrical at the apez, below this tapering gradually to a very fine stipe, 70–90 × 8–10 μ, 8-spored. Ascospores filiform, nonseptate, hyaline, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 50–70 μ long, about 1 μ thick, incased in a hyaline gelatinous sheath 1.5–2 μ thick.

Imperfect stage: Unknown.

Type locality: "Neapolitano, in H. B. (Catanensibus)."

Type specimen: Rabenhorst, Fungi Europaei, No. 2643a.

Host: *Ampelodesmus tenax:* Italy (Rabenhorst, *exs.*)

Exsiccati: Rabenhorst, Fungi Europaei, No. 2643a.

Remarks: In Cesati's original description, the asci are said to measure 135 μ long and 10 μ wide. In our examination of the type material we have been unable to find any asci exceeding 90 μ in length, though the paraphyses do much exceed them and might in some material reach the length reported for the asci.

12. *Lophodermium fuegianum* Spegazzini

Plate V, Fig. 5.

Fungi Fuegianum No. 306. 1887. In Bol. Acad. nac. de Cien. Cordoba 11 : 135-311. 1887.

Hysterothecia minute, shining black, closely crowded and often laterally confluent in small, indefinite, unlimited, light, stramineous areas on stems, oriented parallel to the stem axis, elliptical with abruptly or gently rounded ends, 390–700 μ long, 200–300 μ wide, subepidermal. Labia very indistinct, dark brown and translucent, bordered inwardly by deliquesced masses of periphyses, cover heavily carbonized and opaque except in the region of the labia, involving the epidermal cells, composed of an outer, carbonized region and an inner, dark brown pseudocollenchyma. Basal layer a concave plate two to several cells thick, composed of dark brown pseudoparenchyma; this overlaid to a depth of 6–10 μ by a hyaline, closely interwoven plectenchyma from which the hymenium arises. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded but variously bent and crushed by pressure above and gelatinously agglutinated to form a white epithecium up to 10 μ thick, 60–85 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically rounded and obtuse at the apex, abruptly tapered near the base to a short, broad stipe, 60–80 μ long, 5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 40–55 μ long, 1–1.5 μ wide, without a conspicuous gelatinous matrix.

Type locality: Staten Island, Tierra del Fuego.

Type specimen: Herbario Spegazzini No. 1007, in Museo de La Plata.

Host: *Rosthkovia grandiflora:* Staten Island, Tierra de Fuego (Spegazzini, specimen).

Specimen seen: The type.

13. *Lophodermium gramineum* (Fries) Chevallier

Hysterium culmigenum β gramineum Fries, Systema Mycologicum vol. 2, p. 591. 1823.
Hysterium gramineum Persoon, in Mougeot & Nestler, Stirp. Crypt. No. 368. 1812.
Lophodermium gramineum Chevallier, Flore gen. des env. de Paris vol. 1, p. 435. 1826.
Hysterium seriatim Libert, Plantae cryptogamicae, quas in Arduenna collegit. No. 374. 1837.
Lophodermium arundinaceum β gramineum Duby, Memoir Soc. Phys. et Hist. Nat. Geneve 16 : 59. 1881.
Hysterium breve Berkeley, Amer. Journ. Sci., Arts, 2 ser., 11 : 62. 1851.
Hysterium Robergei Desmazierès, Plantes crypt. du Nord de la France, ser. 2, No. 169, 1853 (?) and Mém. Soc. Sci., Lille 1842 : 30. 1843.
Lophodermium breve de Notaris, Giorn. Bot. Ital. 2 : 47. 1847.
Lophodermium seriatim de Notaris, Giorn. Bot. Ital. 2 : 27. 1847.
Lophodermium Robergei Saccardo, Sylloge Fungorum 2 : 796. 1883.

Hysterothecia dull black, ovate, scattered on sheaths, long axis parallel with sheath veins, ends abruptly rounded or obtuse, 600–825 × 240–375 μ, well arched above and opened widely, subepidermal. Labia widely opened at maturity and extending to within 100 μ of each end of the hysterothecium, very heavily carbonized, 40–50 μ wide, lined inwardly by persistent, hyaline, cylindrical, gelatinously compacted periphyses 9–12 μ long and 3–3.5 μ wide. Basal layer 2 to 4 cells thick, non-aliform, composed of brown, translucent pseudoparenchyma, 8–10 μ thick; this overlaid by a very finely constructed hyaline plectenchyma 4–5 μ thick from which the hymenium arises. Cover non-aliform, heavily carbonized and opaque, involving the epidermal cells and extending outward at the ends in straggling mycelial strands occupying the cavities of the epidermal cells, thin at the margins and 30–45 μ thick near the labia. Paraphyses hyaline, straight, simple, neither swollen nor curved at the tips but variously bent or crushed by pressure, 70–90 × 1–1.5 μ. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered toward the base to a fine, short stipe, 65–85 × 8–10 μ, 8-spored. Ascospores filiform, hyaline, continuous, straight, somewhat twisted or coiled within the ascus, fasciculate and arranged in pairs, 55–80 × 0.75–1 μ, each incased in a thin, hyaline, gelatinous sheath.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: Not given by Fries.

Hosts: *Poa* sp.: France (Roumeguère, *exs.*), Austria (Jaap, 1916); *P. bulbosa:* France (Chevallier, 1826); *P. compressa:* France (Chevallier, 1826); *P. nemoralis:* Saxony (Kunze, *exs.*)

Exsiccati: Mougeot & Nestler, Stirp. Crypt. No. 368 (Cited by Fries and probably to be regarded as the type); Roumeguère, Fungi Gallici exs. No. 1461; Kunze, Fungi Sel. exs. No. 161.

14. *Lophodermium herbarum* (Fries) Chevallier

Hysterium herbarum Fries, Systema Mycologicum vol. 2, p. 593. 1823.
Lophodermium herbarum Chevallier, Flore gén. d. env. d. Paris, vol. 1, p. 437. 1826.
Aporia herbarum Duby, Mém. Soc. Phys. et Hyst. Nat. Genève 16 : 52. 1861.
Lophodermium herbarum Fuckel, Symbolae Mycologicae, App. II. p. 50. 1873.
Lophodermium alliaceum Feltgen, Vorstud. Pilzbl. Grossh. Luxemburg, Nacht. 4 : 34. 1905.

Hysterothecia arranged in longitudinal rows between the veins of the host leaf, in indefinite spots or without spots in rotted and practically disintegrated leaves, surrounded by lighter stramineous areas of variable extent when on petioles and ribs, subepidermal, dull black, oval with abruptly rounded ends, 450–825 × 225–300 μ. Labia prominent, deeply carbonized and much thickened, extending only through the central half and usually not over half as long as the hysterothecium, quite regular in width and up to 30 μ wide, lined on the inner edges with a heavy layer of hyaline, soon evanescent periphyses 10–20 μ long and 1.5 μ wide. Basal layer 2 to several cells thick, of loose, large-celled brown pseudoparenchyma, this overlaid by a hyaline, fine-stranded plectenchyma 10–20 μ thick from which the hymenium arises. Cover consisting of a brown pseudoparenchyma ranging from 2 to 10 cells thick and the epidermal cells compactly filled with brown cylindrical hyphae; no aliform cells present. Paraphyses hyaline, straight or bent by pressure towards the tips, not clavately expanded, their upper portions surrounded by a sheath of gelatin 2–3 μ thick and, at the tips, coalescing into a deep gelatinous epithecium, 1–1.5 μ thick and 90–100 μ long. Asci cylindric to subclavate, asymmetrically subacute above, tapered from below the middle to the base, 100–110 × 10 μ, 8-spored. Ascospores filiform, straight, continuous, hyaline, up to 80 μ long, 2 μ wide.

Imperfect stage: Not named. Hilitzer (1929) describes pycnidia 100–200 μ in diameter.

Type locality: Not given by Fries.

Type specimen: Scleromyceti Sueciae exs. No. 96.

Host: *Convalaria* (Fries, 1823); *Convalaria majalis:* Bavaria (de Thuemen, *exs.*); *Allium oleraceum:* Luxemburg (Feltgen, 1905, Höhnel, 1906).

Exsiccati: C. Roumeguère, Fungi Sel. exs. No. 4958 (this contains no asci); de Thuemen, Mycoth. Univ. No. 1396; Rehm also cites Fuckel, Fungi rhen. No. 758; Rehm, Ascomyceten No. 623.

Illustrations: Fuckel, Symbolae Mycologicae Nacht. II. pl. 1, fig. 15. 1873.

15. *Lophodermium Koeleriae* Hilitzer

Vědecké spisy vydávané Československou Akademií Zemědělskou 3 : 93. 1929.

Hysterothecia scattered in light stramineous areas on dead leaves and sheaths, arranged parallel with the veins, dull black, minute, broadly elliptic, with obtusely rounded ends, subepidermal, 300–600 × 200–400 μ. Labia heavily carbonized, up to 60 μ wide, lined inwardly by white, gelatinized, filiform periphyses. Basal layer of radiately disposed, non-aliform, brown, translucent cells, usually but one cell thick, this overlaid by a finely interwoven, columnar plectenchyma up to 15 μ thick. Cover well carbonized, non-aliform, including epidermal and sometimes parenchyma cells, 25–45 μ thick, well rounded. Paraphyses abundant, straight, hyaline, the tips neither swollen nor curved but usually much bent or crushed, 75–95 × 1 μ, united above in a shining white gelatinous epithecium about 5 μ thick. Asci cylindrical to subclavate, broadly and obtusely conical and asymmetrical at the apex, tapered below to a broad stipe, 70–85 × 6–9 μ; 8-spored. Ascospores hyaline, filiform, continuous, fasciculate and arranged in pairs, 50–75 μ long, about 1 μ thick but somewhat attenuated below and above, incased in a hyaline, gelatinous matrix about 1 μ thick.

Imperfect stage: Unknown.

Type locality: Habr, Bohemia.

Type specimen: Not designated.

Host: *Koeleria cristata:* Bohemia (Hilitzer, 1929), Germany (Hilitzer, 1929).

16. *Lophodermium Magniferae* Koorders

Verh. Koninkl. Akad. von Wetenschappen te Amsterdam 13 (4) : 163. 1907.

Hysterothecia scattered in very light stramineous spots on dead leaves, the spots extensive, merged into the darker unattacked parts and without black marginal stromatic mycelial compacts, scattered, dull black on the lamina but shining black on the nerves, strictly hypophyllous, broadly oval in outline with gradually rounded ends, 830–1250 × 415–520 μ, rather flat on top but with protruded labia, subepidermal and without aliform mycelium. Labia heavily carbonized, 50–65 μ wide, up to 30 μ thick, lined inwardly by a dense mass of filiform periphyses 3 μ wide and 30–50 μ long, clavately enlarged at the tips and orange brown in mass. Basal layer 2 to several cells thick, light brown and translucent, the hyphae radiately disposed but not aliform, this overlaid by a finely interwoven, only slightly columnar, hyaline plectenchyma up to 20 μ thick. Cover distinct at the edges from the base, thin at the margins and tending to become thicker and carbonized near the lips, non-aliform in structure, involving the epidermal cells. Paraphyses filiform, hyaline, straight,

exceeding the asci by about 10 μ, about 1 μ in diameter, not expanded or curved at the tips but crushed and gelatinous, forming a heavy yellow-tinted epithecium. Asci cylindrical to subclavate, straight or bent near the base, asymmetrically and subacutely rounded at the tips, tapered from near the base to a broad stipe, 85–100 $\times$ 7–8 μ; 8-spored. Ascospores hyaline, nonseptate, filamentous, fasciculate and arranged in pairs, straight or only slightly twisted with the ascus, 75–90 μ long, 1–1.5 μ wide, uniform in diameter and blunt at each end, inclosed in a thin, hyaline, gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Not given.

Type specimen: Not given.

Hosts: Mango (*Mangifera indica* L. ?): Java (Koorders, 1907), Porto Rico.

Illustrations: Koorders, Bot. Untersuch. Java Pilze p. 163, fig. 6. 1907.

Specimen seen: Seaver & Chardon, Explorations of Porto Rico, No. 1275.

17. *Lophodermium minutum* Hilitzer

Vědecké spisy vydávané Československou Akademií Zemědělskou 3 : 95. 1929.

Hysterothecia scattered in light stramineous areas on the leaf sheaths, oriented parallel to the veins, very dark to black, elliptical, with obtusely rounded ends, 400–700 $\times$ 200–300 μ, subepidermal, subrotund in cross section, inserted on a tenuous weft of dark mycelium. Labia heavily carbonized, up to 65 μ thick, 30–50 μ wide, lined inwardly by tardily evanescent, hyaline periphyses 10–30 μ long, hyaline and clavately enlarged at the tips. Basal layer 1 cell thick, consisting of subradiately arranged, brown, translucent hyphae, this overlaid by a finely interwoven hyaline hypothecium 20–25 μ thick; hymenium 90–110 μ thick, overlaid by a dull white, gelatinous, very thin epithecium. Cover rotund, 20–65 μ thick, involving the epidermal cells and consisting of pseudocollenchymatic to heavily carbonized cells. Paraphyses hyaline, filamentous, simple, straight or variously bent at the tips by pressure, 80–110 μ long and about 1 μ wide, gelatinized at the tips into a thin epithecium. Asci cylindrical to subclavate, asymmetrically subconical and blunt at the apex, tapered below into a broad stipe, 80–100 by quite uniformly 9 μ, 8-spored. Ascospores filiform, straight or somewhat twisted with the ascus, hyaline, fasciculate and in pairs, 60–80 $\times$ 1 μ, inclosed in a hyaline gelatinous matrix 1–1.5 – thick.

Imperfect stage: Unknown.

Type locality: Doly, Czechoslovakia.

Type specimen: Not designated.

Host: *Stipa pennata:* Czechoslovakia (Hilitzer, 1929).

18. *Lophodermium Miscanthi* n. sp.

Plate II, Fig. 8; Plate III, Fig. 1.

Hysterothecia dull black, in extensive and indefinite stramineous spots on leaves and sheaths, broadly elliptical to linear, 650 μ to 3 mm. long, 450–650 μ wide, subepidermal. Labia heavily carbonized, narrow and of uniform width, 20–35 μ wide, up to 30 μ thick, lined on the inner edges with a white mass of hyaline, filamentous, gelatinizing and soon evanescent periphyses 10–15 μ long and 1–1.5 μ wide. Basal layer a brown, translucent pseudoparenchyma 2 or more cells thick, this overlaid to a depth of 20-30 μ by a hyaline, closely interwoven plectenchyma of very fine hyphae, from which the hymenium arises. Cover well arched, carbonized at the margins and in the labia, elsewhere brown and more or less translucent, pseudoparenchymatic, involving the epidermal cells in and near the labia, individual strands aliform, running within the lumina of the cells and ending in enlarged, dichotomoid cells. Paraphyses straight or flexuius, filamentous, hyaline, nonseptate, not expanded apically, bent or crushed at the tips and united by gelatinous matrices into a white epithecium 10–20μ thick, 90–150 μ long, 1 μ or less wide. Asci cylindrical to subclavate, asymetrically and bluntly rounded above, tapered near the base to a broad stipe and foot, 95–120 μ long, 6–8 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight or twisted with the ascus, fasciculate and arranged in pairs, 70–100 μ long, 0.75–1 μ wide.

Imperfect stage: Unknown.

Type locality: Mt. Maquiling, near Los Baños, Province of Laguna, Philippines.

Type specimen: Baker, Fungi Malayana, No. 155.

Host: *Miscanthus sinensis:* Philippines (Baker, *exs.*; Sydow, 1913, Stevens' mss.).

Exsiccati: Baker, Fungi Malayana, No. 155.

The great length of the hysterothecia, as well as the length of asci and spores separate this from *L. arundinaccum*. The mycelium in cells at the edge and in the cover of the hysterothecia appears to be of an aliform nature, but the occurrence of this type of mycelium is usually limited to the edge of the hysterothecium around which it forms a sort of skirt. It does not extend, as a superficial plate, over all the top of the hysterothecium.

19. *Lophodermium Phlei* n. sp.

Plate III, Fig. 2.

Hysterothecia scattered in light stramineous spots of variable size and extent on sheaths and leaves, shining black, oriented parallel with the veins 450–900 μ long by 225–450 μ wide, oblong, elliptical with nearly

straight sides and bluntly rounded ends, slit eventually splitting the entire length of the cover, subepidermal. Labia heavily carbonized, 25–35 μ wide and up to 60 μ thick, spreading widely and becoming extraverted with age, about $\frac{2}{3}$ the length of the hysterothecium and lined inwardly by a mass of white, shining, gelatinous, soon evanescent periphyses up to 3 μ wide, 15–30 μ long, and clavately enlarged at the ends. Basal layer 1 to 2 cells thick, consisting of brown, translucent, radiately disposed plectenchyma, this overlaid by a layer of finely interwoven, hyaline plectenchyma 15–20 μ thick. Cover heavily carbonized only at the margins, involving epidermal cells and merging rather indefinitely into a loose weft of brown cylindrical, meandering mycelium within and below the epidermal cells. Paraphyses filamentous, straight or flexuous, not swollen or curved but variously bent by crushing at the apex and there interwoven into a loose, nongelatinous epithecium, up to 100 μ long and 1 μ or less wide. Asci long cylindrical to subclavate, asymmetrically subacute at the apex, somewhat tapered to a broad base or to a long stipe, 60–70 × 5–9 μ, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, 50–60 by about 1 μ, incased in a thin, hyaline gelatinous matrix.

Imperfect form: Unknown.

Type locality: Newfield, New Jersey.

Type specimen: Ellis, North American Fungi No. 465.

Host: *Phleum pratense:* type locality only.

Exsiccati: Ellis, N. Amer. Fungi No. 465.

20. *Lophodermium pinicolum* n. nom.

Plate IV, Fig. 12.

Hysterium pinastri Schrader, Schrad. Jour. Bot. 2 : 69. 1799, in part.
Hysterium limitatum Wiebel, Primitiae Florae Werth. p. 329. 1799, in part.
Hypoderma pinastri De Candolle, in Lamarck and De Candolle, Flore Français, 3rd Ed. 2 : 305. 1815.
Hysterium pinastri Fries, Systema Mycologicum vol. 2 : p. 587. 1823, in part.
Hypodermium sparsum Link, Sp. Plant. 6 (2) : 88. 1824, in part.
Aporia obscura Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 63. 1861, in part.
Depazea linearis Rostrup, Tidsskr. Skovbr. 6 : 260. 1883, in part.
Schizothyrium obscurum Saccardo, Sylloge Fungorum 2 : 725. 1883, in part.
Lophodermium baculiferum Mayr, Die Waldungen von Nordamerica, p. 313. 1890.
Scolecodothis pinicola Miles, Mycologia 18 : 165. 1926. (In part ?).
Lophodermium australe Dearness, Mycologia 18 : 242. 1926.
Lophodermium Laricis Dearness, Mycologia 18 : 243. 1926.
Lophodermium pinastri (Schrader *ex* Fries) Cheval., *pro* Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : 69. 1932.

Hysterothecia dull to shining black, amphigenous, one to several in longitudinal sections of the leaf on most hosts sharply marked off by heavy, black stromatic lines from adjacent sections, the leaf breaking

readily along these lines, elliptical with subacute ends, 700–1750 μ long by 300–750 μ wide, subepidermal, 150–350 μ deep. Labia prominent, very long, heavily carbonized, up to 90 μ wide, tapered somewhat toward each end, opening widely, lined inwardly by a layer of hyaline, papillate, gelatinous, soon evanescent periphyses. Basal layer of colorless or slightly brown translucent pseudoparenchyma, this overlaid by a fine, hyaline, closely interwoven plectenchyma 15–30 μ thick from which the hymenium arises. Cover a brown plectenchyma, chiefly pseudocollenchymatic, thin at the edges, 30–45 μ thick, heavily carbonized in the lip region. Paraphyses filiform, hyaline, simple, nonseptate, clavately enlarged at the tips, 100–165 μ long, 1.5–2 μ wide, forming a gelatinous, white epithecium 10–15 μ thick. Asci cylindrical to subclavate, asymmetrically subacute at the apex, tapered from about the middle to a short, fine stipe, 120–150 μ long, 10–14 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, bluntly rounded at both ends, lying straight in the ascus or tending to become intricately coiled in the upper half, 85–140 μ long, 1.5–2 μ wide, incased in a hyaline, gelatinous matrix about 2 μ thick.

Imperfect stage: Leptrostroma pinastri Desm., Ann. Sci. Nat. 19 : 338. 1843, according to Diedicke (1913). *Gloeosporium Pini* Oudeman, Nederl. Kruidkund. Arch. ser. 3, 2 : 754. 1902, according to v. Luyk (1923).—Pycnidia subepidermal, elliptical, 300–500 × 85–100 μ; conidia bacillar, 6–9.5 × less than 1 μ (about .5).

Type locality: Not given by Schrader or Fries.

Type specimen: Not in existence, Fries cites *Scl. Suec. exs.* No. 50.

Hosts: *Pinus*, sp. undet.: Japan (Darker, 1932), Italy (Traverso, 1903); *P. albicaulis*: Oregon (Darker, 1932); *P. Armandi*: Massachusetts (Darker, 1932); *P. attenuata*: Oregon (Darker, 1932); *P. Banksiana*: Michigan, Minnesota, Wisconsin (Davis, 1914), Ontario, Manitoba (Bisby, 1924), Quebec (Darker, 1932): *P. contorta*: California (Boyce, spec.), Oregon, Wyoming, British Columbia (Darker, 1932), Denmark (Rostrup, 1888); var. *latifolia*: Colorado (Clements, *exs.*), Montana (Rhoads, spec.), Alberta (Darker, 1932); *P. echinata*: Arkansas (Darker, 1932); *P. excelsa*: India (Darker, 1932); *P. Jeffreyi*: California (Darker, 1932; Boyce, spec.), Washington (Darker, 1932; Boyce, spec.); *P. koraiensis*: Massachusetts, Jugoslavia (Darker, 1932); *P. monticola*: Massachusetts (Darker, 1932); *P. mugo*: Massachusetts (Darker, 1932) Illinois, Austria (Jaap, 1908), Denmark (Darker, 1932), Germany (Jaap, 1905); var. *rotundata*: Germany (Tubeuf, 1901, 1910); *P. nigra*: Denmark; var. *austriaca*: Oregon, Ontario (Darker, 1932), Italy; var. *cebennensis*: Denmark (Darker, 1932); *P. occidentalis*: Santo Domingo (Toro, 1927); *P. parviflora*: California, Massachusetts (Darker, 1932); *P. Pinaster*: Denmark (Darker, 1932); *P. ponderosa*: Cali-

fornia (Meinecke, spec.), Idaho, Massachusetts, Montana, Oregon, Pennsylvania, Washington, Wyoming (Darker, 1932); *P. radiata*: California (Boyce, spec.), New Zealand (Anon., 1919); *P. resinosa*: Maine, Massachusetts, New Hampshire, Ontario, Quebec (Darker, 1932); *P. rigida*: Maine, Massachusetts, New Jersey, Pennsylvania (Darker, 1932; Orton, spec.; Orton and Hass, spec.; Overholts, spec.), Denmark, Germany; *P. sabiniana*: California (Darker, 1932; Boyce, spec.); *P. sylvestris*: Massachusetts, Quebec (Darker, 1932), Austria (Keissler, 1907), Bulgaria (Malkoff, 1908), Carinthia, Denmark, Germany (Jaap, 1905), Norway (Darker, 1932), Russia (Darker, 1932), Scotland (Darker, 1932), Sweden (Darker, 1932); *P. cembra*: Austria (Jaap, 1908); *P. halepensis*: Austria (Jaap, 1916); *P. Strobus*: Maine, Massachusetts, Ontario (Darker, 1932), Wisconsin (Davis, 1914), Germany; *P. Taeda*: Florida, Louisiana (Darker, 1932), Mississippi (Miles, 1926), North Carolina (Darker, 1932).

Exsiccati: Cooke, Fungi Brit. exs. No. 396; Krieger, Fungi Saxonici Nos. 383, 1170, 1171; Petrak, Mycoth. Carpat., No. 20; Rabenhorst, Fungi europaei Nos. 371, 1443, 1922; Ravenel, Fungi caroliniani, No. 40; Roumeguère, Fungi sel. exs. No. 6941; Saccardo, Mycoth. italica No. 506; Sydow, Mycoth. Germ. No. 1931; Sydow, Myc. Marsh. No. 1376; Zopf & Sydow, Mycoth. Marsh. No. 93; de Thuemen, Fungi Austriaci No. 5056; Ravenel, Fungi amer. exs. No. 322; de Thuemen Mycoth. univ. No. 282, Ellis, North American Fungi No. 675; Ravenel, Fungi amer. exs. No. 180: Clements, Crypt. Format. Colo. No. 466; Krieger, Schad. Pilze, Konigstein, without a number.

Specimens: E. P. Meinecke, Modoc Nat. Forest, July 3, 1913; Boyce, Cisco, Cal., March 16, March 22, 1919; Wind River Nursery, Wash., May 17, 1916; C. R. Orton, Pine Grove Mills, Pa., Aug. 30, 1913; C. R. Orton and A. R. Hass, Pine Grove Mills, Pa., May, 1914; A. S. Rhoads, Fishtrap, Mont., Aug. 15, 1914; L. O. Overholts, Charter Oak, Huntingdon Co., Pa., May 29, 1921.

Illustrations: Tubeuf, Arb. Biol. Abth. Rost.-u. Landw. Kaiserl. Gesundh. 2 (1) : pl. 1, figs. 1–11; pl. 2, figs. 1–24; pl. 4, figs. 1–13; pls. 5–7. 1901.—Greville, Scot Crypt. Fl. 1: pl. 60, figs. 1–4, 1823.—Schrader, Schrad. Jour. Bot. 2 : pl. 3, fig. 4. 1799.—Rostrup, Tidsskr. Skovbr. 6 : p. 259, fig. 6; p. 260, fig. 7; p. 261, figs. 8–9. 1883. *ibid.* 12 : p. 203, fig. 4a. 1891—Hagem, Zeitschr. Forst.-u. Jagdwesen 43 : Pl. 4, figs. 1–8. 1911.—Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : pl. 17, figs. 11–14; pl. 18, figs. 1–9; pl. 19, figs. 1–7; pl. 20, figs. 1–3. 1932.—Hilitzer, Vědecké spisy vydáv. Českosl. Akad. Zeměd. 3 : fig. 11. 1929.—See also Saccardo, Sylloge Fungorum 19 : 1140–1141. 1910.

Notes: *Lophodermium Pinastri* presents an intricate taxonomic tangle. Since the description of the species in Hysterium by Schrader (1799), by Wiebel (1799), and by subsequent workers and in Lophodermium by Chevallier, (1826), it has been understood as having a general range among conifers. But Chevallier, in transferring it to Lophodermium, appears to have had at hand exemplary material on Picea. This is now well recognized as separate from all forms on Pinus. What purports to be Chevallier's type material (see p. 80) is distributed in No. 1661 of Roumeguère's Fungi Gallici exsiccati. It appears that Chevallier's type defines the name, *L. pinastri,* as applicable to the fungus on Picea rather than to those on Pinus. Of the fungi on Pines included in the general concept of the name, there are two distinct kinds. One is subcuticular in position and provided with distinctly aliform mycelium. The other is subepidermal and lacks aliform mycelium. To the first of these, Darker (1932) has given the name *L. nitens.* The other group remains unnamed, and *L. pinicolum* is suggested for it.

L. pinastri f. uncinata Roumeguère, Fungi selecti exsiccati No. 6941, appears not to be distinct from the species.

21. *Lophodermium Secalis* Hilitzer

Vědecké spisy vydávané Československou Akademií Zemědělskou 3 : 96. 1929.

Hysterothecia scattered in stramineous areas on dead leaves and sheaths, dull black, opaque, elliptical with obtusely rounded ends, oriented parallel with the veins, flat to somewhat arched, 500–1200 × 300–500 μ, subepidermal and immersed in a tenuous weft of dark brown mycelium. Labia prominent, heavily carbonized, 20–35 μ wide, up to 75 μ thick, lined inwardly with hyaline, early deliquescent, clavate periphyses 10–15 μ long. Basal layer 5–8 μ thick, without evident radiate composition, overlaid by a finely constructed, hyaline, columnar hypothecium, up to 15 μ thick. Cover pseudocollenchymatic, involving the epidermal and also often some parenchyma cells, 20–45 μ thick. Paraphyses hyaline, filamentous, straight or widely arcuate at the tips, 90–110 μ long by 1–1.5 μ wide, somewhat gelatinized in the white epithecium. Asci cylindric to subclavate, attenuated below to a fine foot, asymmetrically subacute at the tips, 60–100 × 8–10 μ, 8-spored. Ascospores straight or somewhat twisted with the ascus, fasciculate and arranged in pairs, about 1 μ in diameter and 50–80 μ long, incased in a hyaline gelatinous, and often conspicuous gelatinous matrix 1–2 μ thick.

Imperfect stage: Unknown.

Type locality: Klinec, Czechoslovakia.

Type specimen: Not designated.

Host: *Secale cereale:* Czechoslovakia, also in diverse regions of Europe (Hilitzer, 1929).

Exsiccati: Fuckel, Fungi Rheniani No. 2557.

22. *Lophodermium Sieglingiae* Hilitzer

Vědecké spisy vydávané Československou Akademií Zemědělskou 3 : 92. 1929.

Hysterothecia in light stramineous areas on blades and sheaths of dead leaves, elliptical with obtuse or rarely subacute ends, black and somewhat shining, minute, 500–1000 × 200–500 μ, arranged in longitudinal rows between and oriented parallel with the veins, subepidermal, with a basal cushion of dark pseudoparenchyma up to 8 μ thick. Labia prominent, well developed, lined inwardly with deliquescent, hyaline periphyses. Basal layer not clearly distinguished from the basal cushion, 10–15 μ thick, of brown, non-carbonized, translucent plectenchyma. Cover pseudoparenchymatic, involving the epidermal cells and sometimes bundles of sclerenchyma cells, 15–40 μ thick, heavily carbonized at maturity. Paraphyses hyaline, straight or variously bent at the tips, about 1 μ wide and exceeding the asci by 5–10 μ gelatinate above the asci in a white epithecium 5–10 μ thick. Asci cylindrical to subclavate, with thin bases, apex asymmetrically subconic, 60–70 μ long, 6–8 μ wide, 8-spored. Ascospores straight, hyaline, 45–60 μ long by about 1 μ wide, somewhat attenuated toward the ends, fasciculated and arranged in pairs, without a conspicuous gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Habr, Bohemia.

Type specimen: Not designated.

Host: *Sieglingia decumbens*: Bohemia (Hilitzer, 1929).

23. *Lophodermium typhinum* (Fries) Lambotte

Hysterium typhinum Fries, Systema Mycologicum vol. 2, p. 590. 1823.
Lophodermium typhinum Lambotte, La flore mycologique de la Belgique, vol. 2, p. 452. 1880.

Hysterothecia dull black, chiefly epiphyllous, oriented parallel to and arranged in rows between veins of dead leaves, without distinguishable spots, broadly elliptical, mostly with truncated but sometimes with acute ends, 300–675 μ long, 135–330 μ wide, subepidermal. Labia distinct, narrow, of even width, heavily carbonized and tending to become extraverted, opening widely in the middle region, remaining closely applied near the ends of the ostiole, 35–50 μ wide, 25–30 μ thick, lined inwardly by a white mass of filiform, clavately expanded, hyaline, gelatinizing and very

soon evanescent periphyses 7–12 μ long and 1–1.5 μ wide. Basal layer a plate several cells thick of brown, translucent pseudoparenchyma, the bottom layer of which is radiately disposed; this overlaid to a depth of 10–16 μ by a closely interwoven, hyaline, more or less columnar plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized at the margins and in the vicinity of the labia in young hysterothecia, in old hysterothecia heavily carbonized and opaque throughout, involving the epidermal cells, consisting of several layers of pseudocollenchymatous cells. Paraphyses hyaline, filiform, straight or flexuous, not clavately expanded above but bent by pressure and, near the sides of the hymenium, tending to become markedly uncinate, gelatinously fused above the asci into a white epithecium about 10 μ thick, 65–85 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically acute or subacute at the tips, narrowed near the base to a short, broad stipe, 55–70 μ long, 6.5–9 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or coiled in the ascus, 40–50 μ long, 0.75–1 μ wide, each incased in a conspicuous, hyaline gelatinous matrix 1–1.5 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: None cited by Fries.

Hosts: *Typha angustifolia:* England (Massee, 1895), Germany (Rehm, 1887); *T. latifolia:* New York (Ellis and Everhart, 1892; Peck, spec.).

Specimen examined: Charles H. Peck, without number, at Guilderland, New York, May, 18- ?, on *Typha latifolia.*

2. DERMASCIA, new genus

Hysterothecium elliptical to linear, situated intraepidermally, flattened or applanate, opening by an elongate ostiole lined with periphyses and surrounded by thick or carbonized labia; base and cover not connected at the margins. Hymenium basal and disciform, arising from a basal plectenchyma, consisting of both asci and paraphyses. Paraphyses simple, filamentous, or clavately expanded above, often forming a gelatinous epithecium. Asci essentially cylindrical. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs. Without aliform mycelium.

Genus of the Hypodermataceae, differing from Lophodermium Chevallier in being intraepidermal and from Lophodermellina von Höhnel in lacking aliform mycelium.

Type species: *Dermascia alpina* (Rehm).

KEY TO THE SPECIES OF DERMASCIA

Asci generally more than 125 μ long:
  Ascospores generally over 125 μ long; on Picea.....6. D. filiformis
  Ascospores generally less than 120 μ long; on Abies.....3. D. consociata
Asci generally less than 125 μ long
  Asci generally more than 100 μ long:
    Ascospores 1.5–2 μ wide; on Abies.....8. D. lacera
    Ascospores generally less than 1.5 μ wide:
      Ascospores 1–1.5 μ wide; on Dracaena.....4. D. Dracaenae
      Ascospores 0.75–1 μ wide; on Rubus.....14. D. rubiicola
  Asci generally less than 100 μ long:
    Ascospores 5 μ or more wide.....11. D. oxyasca
    Ascospores less than 3 μ wide:
      Ascospores 2–2.5 μ wide:
        Asci 12–15 μ wide; on Gramineae.....9. D. latispora
        Asci 10–12 μ wide; on Festuca.....5. D. Festucae
      Ascospores narrower, not over 2 μ wide:
        Asci 8–12 mu wide; on Gramineae.....1. D. alpina
        Asci 4–8 μ wide:
          Hysterothecia generally subrotund:
            Epithecium indefinite or absent; on Dilleniaceae.....13. D. rotundata
            Epithecium present; host unrecognized.....10. D. leptothecia
          Hysterothecia generally at least twice as long as wide:
            Periphyses and epithecium bright yellow; on Carex.....2. D. caricina
            Periphyses and epithecium white:
              Periphyses persistent, shining white; host unknown..12. D. Reyesiana
              Periphyses evanescent; on Heteromelis.....7. D. Heteromelis

1. *Dermascia alpina* (Rehm) n. comb.

Lophodermium arundinaceum var. *alpinum* Rehm, Bericht. Natur. hist. Ver. Augsburg 26 : 80. 1881.
Lophodermium alpinum Rehm, Ber. Bayer. Bot. Ges. 13 : 119. 1912.

Hysterothecia minute, dull black, arranged in rows between veins on sheaths and leaves, elliptical to broadly ovate, with rounded or indefinitely apiculate ends from which brown cylindrical hyphae straggle out in the cavities of the epidermal cells, 415–625 μ long, 185–210 μ wide, intraepidermal but entirely lacking in aliform structure. Labia prominent, heavily carbonized and opaque, 30–40 μ wide, 25–35 μ thick, arched and spreading in the middle, lined inwardly by hyaline, soon evanescent periphyses 1.5–2 μ wide, somewhat clavately expanded at the tips and 15–25 μ long. Basal layer a brown, translucent, non-aliform plate 1 cell thick, irregularly margined and distinct and unconnected with the cover; this overlaid to a depth of 5–15 μ by a very finely interwoven, hyaline, non-columnar plectenchyma which forms the hypothecium. Cover very poorly organized, except for the margin and labia, the intervening space consisting of loosely and openly interwoven strands of cylindrical brown hyphae following the direction of the host epidermal cells, without carbonization

except in the labia and in the somewhat compacted marginal region. Paraphyses filamentous, hyaline, straight or flexuous, with slightly expanded tips which are, except beneath the ostiole, greatly crushed and bent, not united by gelatinization above into an epithecium, about 1–1.5 μ wide, 70–100 μ long. Asci cylindrical to subclavate, asymmetrically acute to subacute at the tips, abruptly tapered near the base to a broad stipe, 65–95 $\times$ 8–12 μ, 8-spored. Ascospores filiform, hyaline, non-septate, sometimes straight but mostly intricately coiled within the ascus, fasciculate and arranged in pairs, rounded at the tips and tapering to a somewhat finer base, 57–85 $\times$ 1.5–2 μ, inclosed in a thin hyaline gelatinous sheath up to 1 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Rehm.

Type specimen: Rehm, Ascomyceten No. 319.

Hosts: Grasses, especially species of Sesleria and Nardus: In the high Alps (Rehm, 1887); *Elymus ambiguus:* Larkspur Dell, Colorado (Clements *exs.*)

Exsiccati: Rehm, Ascomyceten No. 319; Clements, Cryptogamae Formationum Coloradensium No. 47.

Notes: Rehm described the asci of this species as being 45–70 $\times$ 9–15 and the spores as 36–50 $\times$ 2.5–3.5 μ. In neither the exsiccatum cited by Rehm nor in the Clements specimen do we find Rehm's dimensions.

2. *Dermascia caricina* (Robert) n. comb.

Text-Fig. 1, p. 118.

Hysterium caricinum Robert, in herb., according to Desmazières, Ann. Sci. Nat., 3 ser., 8 : 180. 1847.

Lophodermium caricinum Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 59. 1861.

Aporia neglecta Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 63. 1861.

Lophodermium arundinaceum var. *caricinum* Rehm, Rabenhorst's Kryptogamen Flora 3 : 47. 1887.

Lophodermium caricinum Rehm, Rabenhorst's Kryptogamen Flora, 2nd Ed., vol. 3, p. 1248. 1896.

Lophodermellina caricina von Höhnel, Ann. Mycol. 15 : 312. 1917.

Hysterothecia dull to shining black, amphigenous, widely separated and arranged in rows between veins in extensive, stramineous spots on leaves, elliptical with rounded ends, 650–1200 μ long, 200–500 μ wide, intraepidermal. Labia carbonized, broad, indefinite, nearly as long as the hysterothecium, extraverted in age, 65–100 μ wide, up to 75 μ thick, lined inwardly by a bright yellow mass of nonseptate, clavately expanded, gelatinously agglutinated periphyses 8–15 μ long by 1–1.5 μ wide. Basal layer a light to dark brown plate one to three cells thick, consisting of

subradiately arranged prosenchymatic cells without aliform character; this overlaid to a depth of 5–20 μ by a closely interwoven, hyaline plectenchyma of very fine hyphae, from which the hymenium arises. Cover well arched, carbonized throughout, non-aliform, its margins even at the sides and erose at the ends, composed of an outer plate of closely interwoven, cylindrical hyphae and, beneath this, a layer of pseudocollenchymatous to completely carbonize cells ranging from 5 μ thick near the margins to 75 μ thick in the region of the labia. Paraphyses filamentous, straight or flexuous, hyaline, nonseptate, simple, somewhat expanded near the tips and also much crushed and bent by pressure, 50–80 μ long, 0.75–1 μ wide, gelatinously agglutinated above the asci and forming a pale to bright yellow epithecium about 10 μ thick. Asci cylindrical to long-subclavate, asymmetrically and acutely conical above, tapered from above the middle to a long, thin stipe, 45–70 μ long, 4–6.5 μ wide. Ascospores hyaline, nonseptate, filiform, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, of uniform diameter, 35–60 μ long, 0.75–1 μ wide, gelatinous sheath inconspicuous.

Imperfect stage: Leptostroma caricinum Fries (Observ. mycol. praecip. ad illustr. floram Suec., p. 361. 1824) according to Fuckel (see Rehm, 1887). Karsten (Acta Soc. pro Fauna et Flora Fenn. 6 : 77. 1890) and Schroeter (Jahresber. Schles. Ges. f. vaterl. Cult. 47 : 179. 1870) have described a pycnidial stage with hyaline conidia 4–5 μ long and 0.5–1 μ wide. In the exsiccatum available to us there is an associated imperfect form classifiable as a Gloeosporium, with acervuli nearly concolorous with the host, 90–150 μ in diameter and producing subpyriform conidia 2–2.5 $\times$ 4.5–6 μ.

Type locality: Not given by Desmazières.

Type specimen: Desmazières, Plantes Crypt. du Nord de la France, ser. 2, No. 168. (See Duby, 1861).

Hosts: Carex spp: New Jersey (Ellis and Everhart, 1892); *C. acuta* (Rehm, 1887); *C. glauca* (Rehm, 1887, Roumeguère, exs.); *C. panicea* (Rehm, 1887), *C. paniculata:* France (Rehm, 1886).

Exsiccati: Roumeguère, Fungi sel. exs. No. 7142. Rehm cites: Fuckel, Fungi rhen. No. 1751 and Rabenhorst, Herb. myc. II, No. 723.

3. *Dermascia consociata* (Darker) n. comb.

Lophodermium consociatum Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : 79. 1932.

Hysterothecia grayish black, mainly hypophyllous on needles first attacked by *Hypoderma robustum*, subcircular to broadly elliptical, 400–650 $\times$ 525–1700 μ, intraepidermal. Labia carbonized, 50–70 μ wide,

up to 130 μ thick, lined inwardly by a white mass of hyaline, clavately expanded gelatinously agglutinated and soon evanescent periphyses 1–1.5 μ wide and 15–30 μ long. Basal layer a brown, translucent, pseudoparenchymatic plate 1 to several cells thick, 16–20 μ thick; this overlaid to a depth of 10–15 μ by a closely interwoven, hyaline plectenchyma from which the hymenium arises. Cover a dark brown, more or less translucent pseudoparenchyma carbonized at the margins and in the labia, 75–130 μ thick. Paraphyses hyaline, filamentous, straight or flexuous, somewhat enlarged at the tips and the longest variously bent and crushed, mostly shorter than the asci and forming no epithecium, 150–180 μ long, about 1 μ wide. Asci cylindrical to narrowly subclavate, 150–180 μ long, 15–18 μ wide, asymmetrically subacute at the tips, tapered from about the middle to a broad base, 8-spored. Ascospores hyaline, filiform, fasciculate and arranged in pairs, nonseptate, abruptly rounded at the apices and tapered to somewhat finer bases, 95–120 μ long, 2–2.5 μ wide, incased in a hyaline gelatinous sheath 2–3 μ thick.

Imperfect stage: Unknown.

Type locality: Government Camp, Oregon.

Type specimen: Darker, July 1929, Government Camp, Oregon (Arnold Aboretum Pathological Herbarium No. 268).

Host: *Abies amabilis:* District south of Mt. Hood, Oregon (Darker, 1932); Washington (Boyce, spec.).

Specimen: J. S. Boyce, Silverton, Wash., May 22, 1916.

Illustrations: Darker, *l. c.*, pl. 21, fig. 10.

4. *Dermascia Dracaenae* (Phil. & Harkn.) n. comb.

Lophodermium Dracaenae Phillips and Harkness, Grevillea 12 : 84. 1884.

Hysterothecia dull or shining black, amphigenous and scattered in light stramineous, unlimited, small to very large spots on leaves, broadly elliptical to oblong, 330–1600 μ long, 225–525 μ wide, sometimes confluent end-to-end, intraepidermal. Labia heavily carbonized, straight and uniform in width, nearly as long as the hysterothecia, tending to become extroverted and cracking with age, 65–110 μ wide, 12–30 μ thick, lined inwardly by a brown-tinted mass of filamentous, clavately expanded, gelatinizing and very soon evanescent periphyses 8–20 μ long and 1–1.5 μ wide. Basal layer a dark brown, hardly translucent plate several cells thick, consisting of compact pseudoparenchyma without evident radial disposition; this overlaid to a depth of 8–15 μ by a closely interwoven, orange-tinted plectenchyma of fine hyphae from which the hymenium arises. Cover much arched, carbonized throughout, non-translucent except at the erose margins, composed of an outer, carbonized plate un-

derlaid, in the region of the labia to depth of 30 μ by brown pseudocollenchyma, non-aliform at the margins. Paraphyses hyaline, filiform, non-septate, simple, straight or flexuous, not clavately expanded but variously crushed or bent at the tips and gelatinously united above the asci in a brown epithecium 15–20 μ thick, 120–150 μ long, 1–1.5 μ long. Asci long cylindrical, abruptly and asymmetrically rounded above, tapered from above the middle to a long, fine stipe, 90–130 μ long, 5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or intricately coiled within the ascus, 60–85 μ long, 1–1.5 μ long, incased in an inconspicuous, hyaline gelatinous matrix.

Imperfect stage: Unknown.

Type locality: San Francisco, California.

Type specimen: Harkness, No. 2514, May, 1881 (in herb. California Academy of Science).

Host: *Dracaena* (*fragrans?*): California (Harkness, specimen; Phillips and Harkness, 1884; Ellis and Everhart, 1892).

Note: The branched paraphyses described by Phillips and Harkness may be attributed to the fact that the hymenia in some hysterothecia are parasitized and the conidiophores of the Penicillium that is present stand among the paraphysis tips. The spore and ascus measurements given above greatly exceed those of the original description as well as those given by Ellis and Everhart (1892), but are nevertheless taken directly from the type specimen.

5. *Dermascia Festucae* (Roumeguère) n. comb.

Plate I, Fig. 1: Plate III, Figs. 3, 4.

Lophodermium culmigenum f. *Festucae* Roumeguère, Fungi Selecti Exsiccati No. 7143, 1897, and Rev. Mycol. 19 : 55. 1897.

Hysterothecia brownish black, epiphyllous, scattered and well separated, situated between veins and oriented parallel with them, not associated with discolored spots, not heavily carbonized, elliptical with truncately rounded ends, 150–180 × 375–600 μ, intraepidermal. Labia well defined, carbonized, 17–22 μ wide, about three-fifths as long as the hysterothecium, opening only narrowly to expose but a small part of the hymenium, lined inwardly with a white mass of gelatinous, soon evanescent, clavately expanded hyaline periphyses 8–15 μ long by 1.5–2 μ wide. Basal layer a very thin, brown tinted plectenchyma; this overlaid by a very closely interwoven layer of hyaline plectenchyma up to 5 μ thick from which the hymenium arises. Cover very thin, consisting of a loose weft of brown, cylindrical, somewhat branched hyphae following the cavities of the epidermal cells. External mycelium hyaline, remotely

septate, 4–4.5 μ wide. Paraphyses filamentous, hyaline, simple, of uniform diameter, crushed or bent above the asci and gelatinized into a thick white epithecium, 90–110 μ long, 1.5–2 μ wide. Asci cylindrical to subclavate, asymmetrically rounded to subacute at the tips, tapered somewhat from near the base to a broad, short stipe, 75–100 μ long, 10–12 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, 65–90 μ long, 2–2.5 μ wide, usually tortuously twisted or intricately coiled in the upper half of the ascus, gelatinous matrix inconspicuous.

Imperfect stage: Unknown.

Type locality: Not known.

Type specimen: Roumeguère, Fungi Selecti Exsiccati No. 7143.

Hosts: *Festuca rubra:* France (?) (Roumeguère, exs.); var. *arenaria:* Bernard Harbor, Canada (Dearness, 1923); *F. ovina:* Switzerland (Jaap, 1907).

6. *Dermascia filiformis* (Darker) n. comb.

Lophodermium filiforme Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : 85. 1932.

Hysterothecia shining black, chiefly hypophyllous, linear with acute ends, from about 900 μ to nearly as long as the leaf, 250–260 μ wide, 250–300 μ deep, occurring singly and, if more than one infection is present, these separated by a distinct, double, black stromatic line along which the leaf readily breaks. Labia heavily carbonized, up to 80 μ wide but not very distinct, 50 to 65 μ thick, lined inwardly by a mass of hyaline or subhyaline, very short periphyses up to 8 μ long by 1.5–2 μ wide, these usually persistent and not gelatinized. Basal layer a loose, brown to subhyaline, translucent plectenchyma 1–2 cells thick; this overlaid to a depth of 20–25 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover consisting of a dark, usually heavily carbonized pseudoparenchyma 50–65 μ thick. Paraphyses filiform, hyaline, straight or flexuous, slightly enlarged at the tips and gelatinously united above the asci into a white epithecium 10–20 μ thick, 140–180 μ long, 1–1.5 μ wide. Asci cylindric, abruptly and asymmetrically subacute at the tips, narrowed below to a long thin stipe, 130–160 μ long, 15–18 μ wide, 8- or sometimes only 4-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, 115–160 μ long, 2.5–3 μ wide, each incased in a conspicuous, hyaline, gelatinous matrix about 3 μ thick.

Imperfect stage: Not named. Darker (1932) describes an associated conidial form as follows: "Pycnidia minute, applanate, waxy, inconspicuous, more or less concolorous with leaf surface. Conidia bacillar to

allantoid, 5–9.5 × 0.8–1.2 μ." This stage was not observed in the portion of the type specimen seen by the writer.

Type locality: Bear Island, Lake Timagami, Ontario, Canada.

Type specimen: G. D. Darker No. 1695, July 1, 1926 (Arnold Arboretum Pathological Herbarium No. 822).

Hosts: *Picea glauca:* Ontario, Quebec; *P. Engelmanii:* Colorado; *P. mariana:* Ontario (Darker, 1932).

Illustrations: Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : pl. 25, figs. 5–10. 1932.

7. *Dermascia Heteromelis* (Phillips & Harkness) n. comb.

Hypoderma Heteromelis Phillips and Harkness, Grevillea 13 : 23. 1884.
Lophodermium Heteromelis Ellis and Everhart, North American Pyrenomycetes, p. 718. 1892.

Hysterothecia dull black, epiphyllous or hypophyllous, scattered but numerous in light, stramineous, indefinite spots up to 1 cm. in diameter, broadly oval with rounded ends, the more elongated ones lunate, sometimes also confluent, 500–675 μ long, 300–375 μ wide, intraepidermal. Labia carbonized, indistinct, ¾ the length of the hysterothecia, not arched and not extroverted, erose on the inner margins, 20–45 μ wide, lined inwardly by a white mass of hyaline, clavately enlarged, gelatinous and very soon evanescent periphyses 8–14 μ long by 1.5–2 μ wide. Cover somewhat arched, heavily carbonized except for triangular areas at the ends, margins erose and conforming to the outlines of the epidermal cells occupied. Basal layer a light brown, translucent plate, 2 to several cells thick, composed of non-aliform, radiately disposed prosenchyma; this overlaid to a depth of 8–12 μ by a closely interwoven hyaline plectenchyma of fine hyphae from which the hymenium arises. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded but variously crushed and bent at the tips, exceeding the asci in height and forming an epithecium 8 to 15 μ thick above them, 90–135 μ long, 1.5–2.0 μ wide. Asci long cylindrical to subclavate, abruptly to acutely and asymmetrically rounded at the tips, tapered from well above the middle to a long or short, fine stipe, 80–105 μ long, 5.0–7.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 60–85 μ long, 1.5–2 μ wide, incased in an inconspicuous, hyaline, gelatinous sheath.

Type locality: Lone Mountain, San Francisco, California.

Type specimen: Harkness, February, 1881. No. 2123.

Host: *Heteromeles arbutifolia:* California (Harkness, spec.).

Specimen examined: The type.

8. *Dermascia lacera* (Darker) n. comb.

Lophodermium lacerum Darker, Contrib. Arnold Arboretum Harvard Univ. 1 : 80. 1932.

Hysterothecia dull to shining black, hypophyllous, arranged in longitudinal rows on each side of the needle, broadly elliptical, 500–750 μ long by 280–400 μ wide, 150–250 μ deep; intraepidermal. Labia prominent, dark but not heavily carbonized, much thickened, 25–40 μ wide, opening widely and often torn by lateral cracks into several lobes, lined inwardly by a mass of hyaline periphyses 5–8 μ long by 1.5–2 μ wide. Basal layer a brown, translucent plate of pseudoparenchyma one to several cells thick which fills the lower halves of the epidermal cells, this overlaid to a thickness of 10–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover a well arched plate of dark brown or somewhat carbonized pseudoparenchyma 40–60 μ thick, often torn by cracks originating in the labia. Paraphyses hyaline, filamentous, simple, nonseptate, straight or flexuous, clavately enlarged at the tips, 110–125 μ long by about 1 μ wide, about equalling the asci and not gelatinized into an epithecium. Asci cylindrical to subclavate, asymmetrically rounded to subacute at the tips, tapered from above the middle to a broad base, 100–125 μ long, 12–16 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, fasciculate and arranged in pairs, rounded at the tips and tapered to acute bases (clavate?), 60–85 μ long, 1.5–2.5 μ wide, incased in a conspicuous gelatinous matrix 3–4 μ thick.

Imperfect stage: Not named: An imperfect form was observed and described by Darker (1932) as having intraepidermal, black, subspherical pycnidia 120–170 μ long and 100–120 μ wide and hyaline, bacillar conidia 3–5 × 1–1.5 μ. The writer did not find this on the portion of the type specimen which he examined.

Type locality: Bear Island, Lake Timagami, Ontario, Canada.

Type specimen: G. D. Darker, No. 1459, June 16, 1925 (Arnold Arboretum Pathological Herbarium No. 820).

Host: *Abies balsamea:* New Hampshire, New York, Pennsylvania (Orton, spec.), Vermont, Ontario (Overholts and Parker, spec.), Quebec (Darker, 1932).

Illustrations: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 22, figs. 1–6. 1932.

Specimens: C. R. Orton, Bear Meadows, Center Co., Pa., May 17, 1917; L. O. Overholts and C. S. Parker, Cochrane, Ont., Aug. 15, 1930.

Notes: The ascospores of this species were originally described as clavate. If this were strictly true, the species should have been referred

to Hypodermella. The ascospores are, however, filiform and only appear clavate because of their rounded tips and pointed bases. The gelatinous matrix in which they are incased is also thicker at the top than at the base and this tends to make the spores appear clavate.

9. *Dermascia latispora* n. sp.

Plate III, Figs. 5, 6.

Hysterothecia shining black, arranged in longitudinal rows in light stramineous, small or extensive spots on leaves and sheaths, elliptical with bluntly to sharply rounded ends, 500–750 μ long, 195–375 μ wide, intraepidermal, in cross-section subspherical, in longitudinal section navicular, 200–225 μ deep. Labia well defined, thick, heavily carbonized, about two-thirds as long as the hysterothecia, spreading but little and exposing but a small part of the hymenium. Basal layer a brown, translucent plate 1 to 3 cells thick of pseudoparenchyma with an obvious radial disposition; this overlaid to a thickness of 10 μ by a closely interwoven, hyaline plectenchyma of very fine hyphae from which the hymenium arises. Cover carbonized at the margin and in the labia, elsewhere brown and translucent, consisting of flattened, crowded hyphae appearing to extend longitudinally in striae separated by walls of the epidermal cells. Paraphyses hyaline to dilutely yellow tinted, filamentous, straight or flexuous, somewhat clavately expanded at the tips and there united by gelatinization into a compact, orange-yellow epithecium 5–8 μ thick, 60–80 μ long by 1–1.5 μ wide. Asci broadly cylindrical to subclavate, asymmetrically rounded at the apex, tapered near the base to a broad, short stipe, 60–72 μ long, 12–15 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight, of uniform diameter, fasciculate and arranged in pairs, 52–66 μ long, 2–2.5 μ wide, gelatinous matrix inconspicuous.

Imperfect stage: Unknown.

Type locality: "Bei sulden am Ortler (Tyrol)." (Rehm, *exs.*)

Type specimen: Rehm, Ascomyceten No. 775.

Host: Gramineae.

Notes: In Rehm's exsiccati, this specimen was issued under the name *Lophodermium arundinaceum* f. *apiculatum* Duby but is distinct not only in its hysterothecial characters but in the characters presented by the asci and paraphyses. The ascospores are broader in this than in any other graminicole species, apparently have no tendency to become coiled in the ascus, and can be demonstrated with difficulty to possess a very thin and inconspicuous gelatinous matrix.

10. *Dermascia leptothecia* (Spegazzini) n. comb.

Plate V, Fig. 1.

Lophodermium leptothecium Spegazzini, Fungi Guaranitici I, No. 307. 1887. In Rev. Mycol. 9 : 89. 1887.

Hysterothecia dull to shining black, amphigenous, scattered in light stramineous areas of variable extent with very fine black, stromatic limiting lines, broadly oval, well arched with abruptly rounded ends, 350–600 μ long, 200–325 μ wide, occasionally confluent end to end, or laterally, so as to appear branched; intraepidermal. Labia carbonized, well arched, raised, becoming extroverted, cracked, and irregular in age, nearly as long as the hysterothecium, 15–25 μ wide, 20–30 μ thick, lined inwardly by gelatinous, hyaline, persistent periphyses. Cover well arched, carbonized in the region of the labia, elsewhere dark brown and more or less translucent, erose at the margins, thickened by the apposition, beneath, of 2 or more layers of dark brown pseudocollenchyma. Basal layer a plate one to several cells thick of dark brown, more or less translucent, noncarbonized, radiately arranged prosenchyma; this overlaid by a hyaline plectenchyma from which the hymenium arises. Paraphyses hyaline, filamentous, nonseptate, straight or flexuous, not clavately enlarged at the tips but variously crushed or bent and gelatinously agglutinated above to form a white epithecium 10–25 μ thick. Asci long-cylindrical to slenderly clavate, asymmetrically rounded above, tapered from above the middle to a long, fine stipe, 100 μ long, 4 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight or twisted with the ascus, 70–75 μ long, 0.75–1 μ wide.

Type locality: Guarapi, Paraguay.

Type specimen: B. Balansa, No. 3861, June, 1883. (Herbario Spegazzini, Museo de La Plata, No. 1009).

Host: *Laurinea:* Paraguay (Balansa, spec.).

Specimen examined: The type.

Note: Descriptive details relating to the hymenium are taken from Spegazzini's drawings and notes on the type specimen packet. In the specimen itself the hymenia have become disintegrated.

11. *Dermascia oxyasca* (Spegazzini) n. comb.

Plate V, Fig. 2.

Lophodermium oxyascum Spegazzini, Fungi Fuegiani No. 308. 1887. In Bol. Acad. Nac. Cien. Cordoba 11 : 135–311. 1887.

Hysterothecia dull or shining black, arranged in rows between sclerenchyma strands, widely spaced and without definite surrounding spots, elliptical with abruptly rounded to truncate ends, 600–700 μ long, 300–360 μ wide, intraepidermal. Labia prominent, well arched, heavily carbonized and opaque, tending to become extravert in age, 40–60 μ wide in the

middle, tapering toward the ends, 17–30 μ thick, lined inwardly by hyaline, clavately expanded, gelatinous and soon evanescent periphyses up to 25 μ long by 0.75–1 μ wide. Cover well arched, dark brown but translucent, carbonized in the region of the labia and at the erose margin, composed of one to several layers of pseudocollenchymatic cells. Basal layer a plate 1 to 4 cells thick of radiately disposed, dark brown, translucent prosenchyma, this overlaid to a depth of 12–15 μ by a finely interwoven, hyaline plectenchyma from which the hymenium arises. Paraphyses hyaline, filamentous, nonseptate, straight or flexuous, not clavately expanded but variously crushed and bent at the tips and forming a white epithecium up to 10 μ thick, 50–70 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically acute at the tips, tapered near the base to a short, broad stipe, 45–60 μ long, 5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or twisted with the ascus, 25–40 μ long, 0.75–1 μ wide, gelatinous matrix inconspicuous.

Type locality: Staten Island, Tierra del Fuego.

Type specimen: Herbario Spegazzini, No. 1004, in Museo de La Plata.

Host: *Gramineae* undetermined: Staten Island (Spegazzini, spec.).

Specimens examined: The type and a second specimen, Herbario Spegazzini No. 1005, without locality but bearing the note "Leg.? No. 6."

12. *Dermascia Reyesiana* (Rehm) n. comb.

Lophodermium Reyesianum Rehm, Leafl. Philippine Bot. 6 : 2233. 1914.

Hysterothecia minute, dull to shining black, amphigenous in darker or lighter discolored areas delimited by fine, black, stromatic lines, subrotund to oblong, with rounded ends, 200–315 μ wide by 250–730 μ long, intraepidermal. Labia nearly as long as the hysterothecium, of uniform width, heavily carbonized, raised, and tending to become extraverted with age, 10–20 μ wide, 10–15 μ thick, lined inwardly by a white mass of clavately expanded, septate, hyaline, gelatinized, persistent periphyses 6–15 μ long and 1.5–2 μ wide. Basal layer a dark brown, translucent plate one to several cells thick, composed of non-aliform, radiately disposed plectenchyma; this overlaid to a depth of 8–20 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover well arched, carbonized at the erose margin and in the labia but translucent brown in the intervening area, composed of a loosely interwoven plectenchyma of non-aliform hyphae. Paraphyses hyaline, filamentous, nonseptate, straight or flexuous, not clavately expanded but variously bent or crushed at the tips, gelatinously agglutinated above the asci into a shining white epithecium 5–10 μ thick, 90–105 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically and bluntly rounded above, tapered below to a fine, long stipe, 70–95 μ long,

5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight or coiled within the ascus, fasciculate and arranged in pairs, 47–55 μ long, 1–1.5 μ wide, incased in an inconspicuous, hyaline, gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Los Baños, Luzon.

Type specimen: C. F. Baker, No. 1585. Aug. 15, 1913. *Leg.* S. A. Reyes.

Host: On fallen, dead leaves: Philippine Islands (Rehm, 1914).

Specimen examined: Part of the type.

13. *Dermascia rotundata* (Sydow) n. comb.

Lophodermium rotundatum Sydow, Ann. Mycol. 12 : 201. 1914.

Hysterothecia dull to shining black, amphigenous in light brown spots up to 5 mm. in diameter and sharply marked off from the unoccupied tissue by a black stromatic line, subrotund to elongate and elliptical, 240–860 μ long, 200–300 μ wide, for the most part of the smaller sizes, intraepidermal. Labia well arched, 190–740 μ long, up to 70 μ wide, heavily carbonized, in the subrotund forms opening widely and cracking, lined inwardly by a white mass of gelatinous, clavately enlarged, soon evanescent, hyaline periphyses 10–20 μ long by 1–1.5 μ wide. Basal layer a brown, translucent, radiately constructed plate 1 cell thick; this overlaid to a depth of 5–10 μ by a closely interwoven, hyaline plectenchyma of very fine hyphae from which the hymenium arises. Cover well arched, heavily carbonized and nontranslucent, up to 50 μ thick, consisting of an outer carbonized region and an inner pseudocollenchymatic layer. Paraphyses hyaline, filamentous, simple, straight or slightly recurved at the tips, not expanded above and scarcely exceeding the asci in height, 60–90 μ long, 1 μ or less wide, epithecium indefinite or absent. Asci very slender, cylindric, asymmetrically and obtusely rounded at the tips, sessile and only slightly narrowed at the bases, 60–85 μ long, 4–6 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight or twisted with the ascus, fasciculate and arranged in pairs, 50–80 μ long, 0.75–1 μ wide, incased in a thin, inconspicuous gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Mt. Maquiling, near Los Baños, Province of Laguna, Philippine Islands.

Type specimen: Baker, Fungi Malayana No. 39.

Hosts: Dilenia sp.: Philippines (Baker, exs., Sydow, 1914); Canarium sp.: Philippines (Baker, exs., 1931).

Exsiccati: Baker, Fungi Malayana Nos. 39 and 546.

Notes: According to Sydow (1914) this differs from *Lophodermium*

Mangiferae Koord. and *L. Canangae* Henn. & Nym. in its smaller, mostly rotund or short-elliptical hysterothecia. Aside, however, from the fact that it is intraepidermal, which distinguishes it from both these species, there are in some colonies very definitely elongated hysterothecia. Sydow's description says, "without spots," but the examples distributed by Baker are very definitely maculicole.

14. *Dermascia rubiicola* (Earle) n. comb.

Lophodermium rubiicolum Earle, Bul. Torrey Bot. Club 25 : 365. 1898.

Hysterothecia shining black, very abundant, crowded, and sometimes confluent end-to-end in unlimited, small to extensive, light stramineous areas on stems, broadly elliptical with rounded ends and erose margins, intraepidermal, 525–1200 μ long, 300–450 μ wide. Labia prominent, heavily carbonized, about ⅔–¾ as long as the hysterothecium, tending to become extroverted in age, 40–65 μ wide, up to 40 μ thick, lined inwardly by a white mass of gelatinizing and very soon evanescent, hyaline periphyses 8–12 μ long by 1–1.5 μ wide. Basal layer a dark brown, translucent plate 2 to several cells thick of non-aliform pseudoparenchyma; this overlaid to a depth of 15–25 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover well arched, erose at the margin in conformity with epidermal cells occupied, heavily carbonized except at the margin, consisting of a closely interwoven, plectenchyma of non-aliform hyphae. Paraphyses hyaline, non-septate, filamentous, straight or flexed, not clavately expanded but variously bent or crushed at the tips, 125–165 μ long, 0.75–1 μ wide, gelatinously coalesced above the asci in a white epithecium 20–35 μ thick. Asci cylindrical, abruptly and asymmetrically rounded above, tapered below to a fine, long stipe, 100–135 μ long, 5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, non-septate, acute at each end, fasciculate and arranged in pairs, straight or intricately coiled within the ascus, 75–95 μ long, 0.75–1 μ wide, incased in an inconspicuous, hyaline, gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Auburn, Alabama.

Type specimen: Underwood and Earle, "Feb. & March, 1896." (In New York Botanical Garden).

Hosts: Rubus sp.:-Dead blackberry stems: Alabama (Earle, 1898, and specimen); dead stems of Rubus: California (H. E. Park, specimen).

Specimens examined: Underwood and Earle's type; H. E. Park, No. 2, Trinidad, California, May, 1931.

Notes: Earle's type specimen does not show, at the present time, the asci and spores described by Earle. The hymenia of the several

hysterothecia I examined had been invaded by a minute species of Penicillium and reduced to yellow masses of homogeneous, gelatinous material. The measurements given by Earle for the asci, 60–70 × 5 μ, are much less, as regards length, than those found in the California material. The fact that Earle noted in his description, yellow color in the ascospores and agglutinated paraphyses indicates that his specimen had already been invaded by the Penicillium and that the asci had not attained full development. Measurements of the asci and ascospores, given in the description above, are taken from the California specimen. For a discussion of *Lophodermium Rubi* (Pers.) Chev., which this species does not resemble in any way, see p. 115.

3. LOPHODERMELLINA von Höhnel (without description)

Berichte der Deutschen Botanischen Gesellschaft 35 : 419. 1917.

Ascomata in the form of hysterothecia, subrotund to elongate, flattened, immersed in the tissues of the host and inserted strictly within the epidermis, composed of separately developed bases and covers that are distinct at maturity and which possess plates of aliform mycelium forming the outer layer of the cover and the bottom layer of the base, opening by means of an elongated ostiole surrounded by more or less carbonized labia and lined with filiform, gelatinizing, persistent or evanescent periphyses. Hymenium consisting of both asci and paraphyses, disciform and strictly basal, arising from a closely interwoven, hyaline plectenchyma of fine hyphae. Paraphyses filamentous, nonseptate, and unbranched. Asci cylindrical, asymmetrically rounded above, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, incased in a gelatinous matrix.

Type species: *Lophodermellina hysterioides* (Persoon) von Höhnel, Ber. der Deutsch. Botan. Gesellsch. 35 : 422. 1917.

KEY TO THE SPECIES OF LOPHODERMELLINA

Asci generally more than 125 μ long; on Picea.....2. L. macrospora
Asci generally less than 125 μ long:
  Asci generally over 100 μ long:
    Gelatinous matrix of ascospores conspicuous; on Abies and Picea..4. L. pinastri
    Gelatinous matrix inconspicuous:
      Paraphyses clavately enlarged, on Psidium.....7. L. subtropicalis
      Paraphyses not clavately enlarged, on Vincentia.....6. L. Stevensii
  Asci generally less than 100 μ long:
    Ascospores 1.5–2 μ wide; on Sorbus.....9. L. tumida
    Ascospores less than 1.5 μ wide:
      Epithecium yellow; on Rosaceae.....1. L. hysterioides
      Epithecium white:
        Asci slender, up to 6 μ wide; on Passiflora.....3. L. Passiflorae
        Asci broader, up to 10 μ wide:
          Paraphyses attenuated from base to tip; on Sesleria.....5. L. Sesleriae
          Paraphyses clavately expanded above; on Triticum.....8. L. Tritici

1. *Lophodermellina hysterioides* (Persoon) von Höhnel

Xyloma hysterioides Persoon, Icon. et descrip. fung. p. 38, 1798 and Synopsis methodica fungorum, p. 106. 1801.
Hysterium Berberidis Schleicher, Plantae Crypt. Helvetiae Exs. No. 182. 1805.
Hypoderma xylomoides De Candole, Flore Française vol. 5, p. 164. 1815.
Hysterium foliicolum Fries, K. Vet. Akad. Handl. 40 : 102. 1819.
Hysterium folïicolum Fries, Systema mycologicum vol. 2 p. 592. 1823.
Lophodermium xylomoides Chevallier, Flore gén. des env. Paris, vol. 1, p. 437. 1826; Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 52. 1861.
Aporia microtheca Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 64. 1861.
Schizothyrium microthecum Saccardo, Sylloge fungorum 2 : 724. 1883.
Lophodermium hysterioides Saccardo, Sylloge fungorum 2 : 791. 1883.
Lophodermellina hysterioides von Höhnel, Ber. Deutsch. Bot. Gesellsch. 35 : 422. 1917 and Ann. Mycol. 15 : 311. 1917.

Hysterothecia shining black, in stramineous or light colored areas of very variable extent without black, stromatic lines on petioles, nerves, veinlets and blades of leaves, narrowly to broadly elliptical with rather acutely rounded ends, 650–1275 μ long, 330–500 μ wide, intraepidermal. Labia of the ostiole nearly as long as the hysterothecium, prominently raised at maturity, heavily carbonized, 20–35 μ wide, lined inwardly by a white mass of septate, cylindrical, gelatinously agglutinated and soon evanescent, hyaline periphyses up to 10 μ long and 1–1.5 μ wide. Basal layer a brown, translucent plate one cell thick of meandering, subradiately disposed aliform hyphae; this overlaid by a layer of closely interwoven, compact hyaline plectenchyma 10–20 μ thick from which the hymenium arises. Cover heavily carbonized throughout, consisting of an outer plate of aliform, meandering cells and, beneath this, a layer very variable in thickness of heavily carbonized pseudocollenchyma. Paraphyses filamentous, hyaline, straight or variously bent and crushed at the tips, not noticeably enlarged above, 85–100 μ long, about 1 μ wide, forming a thin but compact yellow-tinted epithecium. Asci cylindrical to subclavate, bluntly and asymmetrically rounded at the tips, tapering toward the base to a short, fine stipe, 80–100 μ long, 8–10 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, straight or somewhat twisted with the ascus, fasciculate and arranged in pairs, 60–85 μ long, 0.75–1 μ wide, incased in a hyaline gelatinous matrix 1–1.5 μ thick.

Imperfect stage: Leptostroma maculicolum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 78. 1929.–Pycnidia intermixed with the hysterothecia, flat, opaque, 150–200 μ in diameter, 35–70 μ high; excipulum thin, its upper part one layer of brown pseudoparenchyma, its lower part of obscure plectenchyma; pore rounded, 5 μ in diameter. Conidiophores 15–18 μ long, bearing several spores on their somewhat attenuated tips. Conidia bacilliform, straight, nonseptate, 4–5 $\times$ 1 μ.

Type locality: Not given by Fries.

Type specimen: None specified; Fries (1823) cites Schleicher, Exsiccati Nos. 287 and 363.

Hosts: *Amelanchier alnifolia:* Washington (Ellis and Everhart, 1892); *A. ovalis:* Germany (Rehm, exs., 1925); *A. vulgaris:* Austria (Jaap, 1908); *Berberis* sp. (Rehm, 1887); *Crataegus* sp. (Rehm, 1887); *C. coccinea:* England (Berkeley, exs.), Germany (Jaap, 1914); *C. monogyma:* France (Roumeguère, exs.); *Pyrus* sp. (Rehm, 1887); *P. communis:* Serbia (Ranojevic, 1910), Thuringia (Sydow, exs.).

Exsiccati: Berkeley, British Fungi No. 196; Rabenhorst, Fungi europaei No. 1151; Rehm, Ascomyceten No. 1323b; Roumeguère, Fungi sel. Gallici exs. No. 551; Sydow, Mycoth. Germ. No. 493.

The following, which I have not seen, are cited by Rehm (1887) Fuckel, Fungi rhen. No. 742; Mougeot et Nestler, Stirp. Crypt. No. 761 *sub Xyloma umbilicatum* Pers.; Rabenhorst, Herb. myc. II, No. 156; Rehm, Ascomyceten No. 867.

Illustrations: Killian et Likhité, Compt. rend. hebdomad. des seances et mém. Soc. Biologie 1924 2 : 575, figs. 1–15. 1924. Persoon, Icon. et descr. fung. pl. 10, figs. 3, 4. 1798.

Note: The fungus distributed in Rabenhorst's Fungi europaei No. 3869 as *Lophodermium hysterioides* is not, at least in the copy available to me, that species. The ascomata are very broadly oval to subcircular, amphigenous, and scattered over the blade more than the rib or petiole. The host probably is not Pyrus, as given; and this record of *L. hysterioides* on Pyrus sp. in Sardinia should be deleted. The specimen appears immature. There are no asci and the ascomata have not opened.

2. *Lophodermellina macrospora* (Hartig) n. comb.

Plate III, Fig. 7.

Hysterium macrosporum Hartig, Wichtige Krankheiten der Waldbaume, p. 101. 1874.

Hypodermella macrospora Lagerberg, Medd. Stats. Skogsforsoksant. 7 : 113. 1910.

Lophodermium macrosporum Rehm, Rabenhorst's Kryptogamen Flora vol. 3, p. 45. 1887.

Hysterothecia dull to shining black, on the outer faces of needles, 400–650 μ wide, variable in length and extending at times almost the entire length of the needle, intraepidermal. Labia well carbonized and conspicuous, up to 85 μ wide, nearly as long as the hysterothecium, opening widely and exposing much of the orange tinted hymenium. Basal layer a brown, translucent plate 1 cell thick of aliform, radiately disposed hyphae; this covered to a depth of 20–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized near the margins and in the labia but not elsewhere, composed of an outer layer of meandering aliform hyphae and,

beneath this, of a brown pseudocollenchyma, 50–70 μ thick. Paraphyses orange tinted above, straight or variously curved, not expanded above, filamentous, 100–160 μ long, united above in a thick, orange epithecium. Asci cylindrical to subclavate, abruptly and asymmetrically subacute at the tip, tapered near the base to a broad stipe, 100–150 μ long, 14–20 μ wide, 8-spored. Ascospores filiform to subclavate, rounded above, tapered to a fine point below, hyaline, continuous, fasciculate and arranged in pairs until the asci elongate, 50–80 μ long, 2–3 μ wide, incased in a conspicuous, hyaline gelatinous sheath 2–4 μ thick.

Imperfect stage: Hypodermina Hartigii Hilitzer, Vědeké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 57. 1929.–*Vide* Hartig, 1874.

Type locality: Treves, Germany.

Type specimen: Not specified.

Host: *Picea Abies:* Czechoslovakia (Darker, 1932; Hilitzer, 1929, Picbauer, 1932); Denmark (Darker, 1932); France (de Thuemen, exs.); Germany (Hartig, 1874; Jaap, 1914; Krieger, exs., Rabenhorst, exs.); Norway (Darker, 1932); Poland (Krieger, exs.); Sweden (Darker, 1932), Switzerland (Darker, 1932, Kunze, exs.).

Exsiccati: Krieger, Schadliche Pilze: 2 specimens, without number, designated (1) Prebischtor 25.4.1910, 16.6.1897 and (2) juni 1909, both leg. Krieger; Kunze, Fungi sel. exs. No. 374 (Fungi Helv. No. 74); de Thuemen, Nycoth. univ. No. 279.

Rehm (1887) also cites: Rabenhorst, Fungi europ. No. 2411 and de Thuemen, Fungi Austr. 1157. Darker (1932) cites: Krieger, Fungi Sax. No. 777; Petrack, Fl. Boh. and Morav. exs. II ser. No. 2052; and Siemaszko, Fungi Bialow. exs. No. 16.

Illustrations: Hartig, Wichtige Krankheiten der Waldbaume, pl. 6, figs. 1–17. 1874; Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : pl. 4, fig. 17. 1929; Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 25, fig. 4. 1932.

3. *Lophodermellina Passiflorae* (Rehm) n. comb.

Plate III, Fig. 8.

Lophodermium Passiflorae Rehm, Leafl. Philippine Bot. 6 : 2232. 1914.

Hysterothecia dull black, scattered in extensive, light brown, unlimited and poorly defined areas on stems, oval to long elliptical, occasionally confluent, 400–900 μ long, 200–350 μ wide, intraepidermal. Labia pronounced and heavily carbonized, 275–750 μ long, 20–30 μ wide, lined inwardly with a white or yellow mass of hyaline, gelatinous and soon evanescent periphyses 15–25 μ long by 1–1.5 μ wide. Basal layer a light brown, translucent plate 1 cell thick consisting of a radiately arranged prosenchyma, the marginal cells of which are distinctly aliform;

this covered to a depth of 20 μ by a hyaline, closely interwoven plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized at the margins and in the labia, light brown and translucent between these, consisting of a loosely compacted layer of aliform plectenchyma which straggles out from the margins into the host tissue; this underlaid in the region of the labia by several layers of heavily thickened pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or crushed at the tips by pressure, not clavately expanded, 90–125 μ long, 1 μ wide, united above into a firm, white epithecium. Asci cylindrical to subclavate, bluntly and asymmetrically rounded at the tips, tapered toward the base into a short, thin stipe, 65–90 μ long, 4.5–6 μ wide, 8-spored. Ascospores hyaline, filamentous, straight or somewhat twisted with the ascus, nonseptate, 55–80 μ long, 0.75–1 μ wide, gelatinous matrix very inconspicuous.

Imperfect stage: Unknown.

Type locality: Mt. Maquiling, near Los Baños, Province of Laguna, Philippine Islands.

Host: *Passiflora quadrangularis:* Philippines (Rehm, 1914; Baker, exs., 1914).

Exsiccati: Baker, Fungi Malayana No. 38.

Notes: This species, as represented in the set of Baker's exsiccati available to the writer, is deceptive. Of the 10 pieces of stem in the packet, only 2 bear the fungus, the others being attacked by a variety of other fungi. While the hysterothecia are intraepidermal, the aliform nature of their structure is masked to a very considerable extent by the heavy carbonization of the hysterothecial margins and by the tendency, throughout the cover, for the very slightly chytinized fungous cells to occupy areas corresponding to the top halves of the host's epidermal cells. When the host tissue has been sufficiently bleached, however, irregular extensions of the marginal hyphae furnish the typical aliform structure.

4. *Lophodermellina pinastri* (Chevallier) von Höhnel

Plate III, Figs. 9–11.

Hysterium pinastri Schrader, Schrad. Journ. Bot. 2 : 69. 1799, in part.
Hysterium limitatum Wiebel, Prim. Fl. Werth., p. 329. 1799, in part.
Hypoderma pinastri De Candolle, Flore Française, 3rd Ed., vol. 5, p. 305, 1815, in part.
Hysterium pinastri Fries, K. Vet. Akad. Handl. 40 : 101. 1819, in part.
Hysterium pinastri Fries, Systema Mycologicum, vol. 2, p. 587, 1823, in part.
Hypodermium sparsum Link, Species plantarum, 4 Ed., vol. 6; p. 88. 1824, in part.
Lophodermium pinastri Chevallier, Flore gén. des env. de Paris, vol. 1, p. 436 1826.
Aporia obscura Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 63. 1861, in part.

Depazea linearis Rostrup, Tidsskr. Skovbr. 6 : 260. 1883, in part.
Phacidium Piceae Fuckel, Symbolae Mycologicae, Nacht. II, p. 51. 1873.
Schizothyrium obscurum Saccardo, Sylloge fungorum 2 : 725. 1883, in part.
Coccomyces Piceae Saccardo, Sylloge fungorum 8 : 746. 1889.
Lophodermium Abietis Rostrup, Tidsskr. Skovbr. 12 : 201. 1891.
Lophodermium Piceae von Höhnel, Sitzungsb. K. Akad. Wissensch. Wien (Math.-Nat. Kl.) 126 : 296. 1917.
Lophodermellina pinastri von Höhnel, Ann. Mycol. 15 : 311. 1917.

Hysterothecia dull or shining black, in longitudinal rows on either side of the middle ridge of the outer faces of needles, the area occupied by each cut off from adjacent areas by a heavy black, stromatic line which extends across the needle and along which the needle breaks readily, 950–2200 μ long, 450–700 μ wide, elliptical to linear with abruptly rounded ends, intraepidermal. Labia usually heavily carbonized, poorly defined, up to 50 μ wide, lined inwardly by a white mass of gelatinous, clavately enlarged, hyaline periphyses 15–25 μ long and 1–1.5 μ wide. Basal layer a brown, translucent plate 1 to 3 cells thick, consisting of radiately arranged, aliform prosenchyma; this overlaid to a depth of about 5 μ by a closely interwoven, hyaline prosenchyma of very fine hyphae from which the hymenium arises. Cover well arched, carbonized at the margins, very heavily carbonized in the region of the labia, varying from translucent to opaque and carbonized in the intervening area, distinctly aliform in structure. Paraphyses filamentous, straight or flexuous, clavately enlarged at the tips and there incased in a gelatinous matrix by which they are bound together above the asci in a dense white epithecium about 10 μ thick, 90–140 μ long, 0.75–1 μ wide. Asci long-cylindrical to subclavate, asymmetrically acute or subacute at the tips, somewhat tapered below to a broad base, 90–130 μ long, 8–12 μ wide, 8-spored. Ascospores filiform, hyaline, straight or intricately coiled within the ascus, fasciculate and arranged in pairs, nonseptate, 85–115 μ long, 1.5–2 μ wide, incased in a gelatinous matrix up to 2 μ thick.

Imperfect stage: Hypodermina Abietis (Dearness) Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 60. 1929. (*Leptostroma Abietis* Dearness, N. Y. St. Museum Bul. 266 : 65. 1925).–Pycnidia intraepidermal, dark brown, 200–435 μ long, 125–200 μ wide; exciple aliform. Ostiole about 25 μ wide, substomatal. Conidiophores 15–22 μ long, 1 μ wide. Conidia elliptical to oblong, hyaline, straight or subarcuate, 3–4 $\times$ 0.5–0.8 μ.

Type locality: Malmedy, Belgium.

Type specimen: Roumeguère, Fungi Gall. exs. No. 1661.

Hosts: *Abies alba:* Denmark (Rostrup, 1891; Lind. 1913); *A. balsamea:* Ontario (Darker, 1932); *A. concolor:* Oregon (Darker, 1932); *A. lasiocarpa:* Oregon (Darker, 1932); *Picea Abies:* Massachu-

setts and Oregon (Darker, 1932), Denmark (Rostrup, 1891; Lind, 1913), Belgium (Roumeguère, exs.), Germany (von Höhnel, 1917; Jaap, 1914); *P. glauca:* Michigan, Ontario, and Quebec (Darker, 1932), Denmark (Rostrup, 1891; Lind, 1913); *P. Engelmanii:* Oregon (Darker, 1932); *P. mariana:* Ontario and Quebec (Darker, 1932); *P. rubra:* New York (Darker, 1932); *P. sitchensis:* California and Oregon (Darker, 1932), Denmark (Rostrup, 1891; Lind, 1913), Scotland (Darker, 1932). See also Jaap (1914), Sydow, *et al.* (1911), and Hilitzer (1929).

Exsiccati: Roumeguère, Fungi Gall. exs. No. 1661; de Thuemen, Fungi Austr. No. 1059; Fuckel, Fungi rehn. No. 2561.

Illustrations: Rostrup, Tidsskr. Skovbr. 12 : 201, fig. 3; 203, fig. 4b. 1891; Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 1, fig. 3; pl. 23, figs. 1–11; pl. 24, figs. 1–11; pl. 25, figs. 1–3. 1932.

The treatment given this species by Darker (1932) appears to have been based on a misconception of the type. Following the studies of von Tubeuf (1901, 1910), Haack (1911), Lagerberg (1914), and Hagem (1928), he has limited the species to the genus Pinus, as to hosts, upon which he finds it to be widely distributed throughout the northern hemisphere. In this, it is assumed that *Lophodermium pinastri* Chevallier is in all respects synonymous with *Hysterium pinastri* Schrader; but this assumption is not justified. Though Chevallier (1826) probably considered the two to be synonymous, the material with which he dealt was on *Picea Abies.* What purports to be type material is to be found in Roumeguère's Fungi Gallici exsiccati, No. 1661, under the following label:

1661. Lophodermium pinastri (Schrad.) Chev. Fl. Paris.
(Type)
Sur les Aiguilles des Pins.
Malmedy (Reliq. Libertianae)

If, as seems likely, this specimen is part of the material with which Chevallier dealt, it should be held to typify the species and should not be confused with material cited by Schrader, Fries, or others. The Roumeguère specimen is not on pine, but on Picea and, from our determination, on *P. Abies* Karst. This is, of course, not contrary to Chevallier's original description, in which the host of the fungus is stated to be "*pin sauvage,*" for which the common meaning is not necessarily restricted to the genus Pinus but may extend also to other evergreens.

This fungus, on Picea and Abies, was recognized as a species distinct from the *Lophodermium pinastri* of Schrader and Fries by Fuckel (1873), by Rostrup (1891), and by von Höhnel (1917); and von Höhnel transferred it to his new genus Lophodermellina (1917). According to Darker (1932), von Höhnel's material was all *L. Piceae.* Hence, it appears that von Höhnel has rightly interpreted the species.

The report by Lind (1913) of this species on Pseudotsuga has been shown by Boyce (1928) to be erroneous. This and certain other hosts listed by Hilitzer (1929) are taken directly from Lind and should be interpreted in the light of Boyce's report.

5. *Lophodermellina Sesleriae* (Hilitzer) n. comb.

Lophodermium Sesleriae Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 91. 1929.

Hysterothecia shining black, scattered in light stramineous, unlimited spots on leaves, sheaths, and culms, elliptical to oblong, always attenuated at the ends and appearing almost fusiform, 700–1000 μ long, 200–600 μ wide, intraepidermal. Labia indistinct, poorly differentiated, up to 35 μ wide, lined inwardly by hyaline periphyses up to 10 μ long. Basal layer a brown, translucent plate one cell thick of radiately disposed, aliform hyphae, this overlaid to a depth of 10–15 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover more or less carbonized, consisting of an outer plate of radiately disposed, aliform hyphae, thickened by the apposition beneath of brown pseudocollenchyma to a depth of 15–25 μ. Paraphyses hyaline, filamentous, straight or flexuous, about equalling the asci, not clavately expanded above and not forming an epithecium, 80–100 μ long, 2 μ wide at the base, 1 μ wide at the tips. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered below to a long, thin stipe, 75–100 μ long, 9 μ wide, 8-spored. Ascospores hyaline, nonseptate, filiform, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 55–75 μ long, 1–1.5 μ wide, incased in an inconspicuous, hyaline, gelatinous matrix about 1 μ thick.

Imperfect stage: Unknown.

Type locality: Not specified by Hilitzer.

Type specimen: Not designated by Hilitzer.

Host: *Sesleria coerulea:* Central Bohemia (Hilitzer, 1929), Germany, Italy, Switzerland (Hilitzer, 1929).

6. *Lophodermellina Stevensii* n. sp.

Hysterothecia dull black, amphigenous, scattered in light stramineous areas of variable extent on blades of dead leaves, elliptical to linear with abruptly rounded ends and erose margins, 475–1150 μ long, 200–315 μ wide, intraepidermal, arranged without reference to the directions of the veins of the host. Labia prominent, extroverted and cracking away with age, nearly as long as the hysterothecia, very heavily carbonized, of uniform width throughout their length, up to 55 μ wide, 30 μ thick, lined

on the inner edges by hyaline, clavately expanded, gelatinizing and very soon evanescent periphyses 8–15 μ long by 1.5–2 μ wide. Basal layer a plate 2 to several cells thick, consisting of dark brown, translucent pseudoparenchyma without evident radiate distribution but distinctly aliform at the margin; this overlaid to a depth of 8–20 μ by a closely interwoven, hyaline, fine plectenchyma from which the hymenium arises. Cover a loosely to compactly interwoven plate of brown, translucent, aliform, hyphae, non-carbonized except in the labia and at the erose margin. Paraphyses hyaline, straight or flexuous, very slightly or not at all enlarged at the tips but interwoven there into a dense, gelatinously compacted epithecium up to 30 μ thick, 100–130 μ long by 1 μ thick. Asci long cylindrical, asymmetrically conical and subacute at the apex, gradually tapered from well above the middle to a fine, long stipe, 90–110 μ long, 5–7 μ wide, 8-spored. Ascospores hyaline, nonseptate, straight or coiled once in the upper part of the ascus, fasciculate and arranged in pairs, somewhat tapered at each end, about 75 μ long and 1–1.5 μ wide, gelatinous matrix very thin and inconspicuous.

Imperfect stage: Unknown.

Type locality: Mt. Olympus, Island of Oahu, Hawaii.

Type specimen: Stevens, Hawaiian Fungi No. 727.

Host: *Vincentia angustifolia:* Hawaii (Stevens, 1925, and in exs.).

Exsiccati: Stevens, Hawaiian Fungi Nos. 246, 373, 622, 652, and 727.

7. *Lophodermellina subtropicalis* (Spegazzini) n. comb.

Plate V, Fig. 3.

Lophodermium subtropicale Spegazzini, Anal. Museo Nac. Buenos Aires 23 : 88. 1912.

Hysterothecia dull black, oriented parallel with the stem axis in longitudinally extensive, cinereous areas sharply delimited by fine, black, stromatic lines, narrowly elliptical with indeterminate margins and ends, 1200–2100 μ long, 500–750 μ wide, intraepidermal. Labia indistinct, carbonized and opaque, bordered inwardly by a gelatinous mass of deliquesced periphyses. Cover heavily carbonized and opaque except at the margin, there extending to a distance of 250 μ or more beyond the margin of the base and filling the epidermal cells with loose wefts of dark brown, translucent, aliformly terminated hyphae. Basal layer an indefinite plate, hyaline and translucent in the middle, dark brown to opaque at the margins; this overlaid by a closely interwoven hyaline plectenchyma from which the hymenium arises. Paraphyses filamentous, hyaline, straight or flexuous, markedly clavately enlarged at the tips which are gelatinously agglutinated above the asci into a shining white epithecium 5 to 8 μ thick, 120–160 μ long, 1–1.5 μ wide. Asci long

cylindrical to subclavate, asymmetrically acute at the tips, tapered from about the middle to a long, slender stipe, 100–150 μ long, 6.5–8 μ wide, 8-spored. Ascospores filiform, hyaline, non-septate, fasciculate and arranged in pairs, straight or coiled within the ascus, 70–100 μ long, 1–1.5 μ wide, incased in a thin and inconspicuous, hyaline, gelatinous sheath.

Type locality: Puerto Leon, Misiones, Argentina.

Type specimen: Herbario Spegazzini No. 1008, September 1909.

Host: *Psidium* sp. : Argentina (Spegazzini, spec.).

Specimen examined: The type.

8. *Lophodermellina Tritici* (Roumeguère) n. comb.

Plate III, Fig. 13.

Lophodermium arundinaceum f. *Tritici* Roumeguère, Fungi selecti exsiccati No. 6144, 1892, and Rev. Mycol. 14 : 168. 1892.

Hysterothecia shining black, in longitudinal rows between veins in extensive, light stramineous spots on sheaths and stems, elliptical to oblong, pointed at the ends, 650–1500 μ long, 300–450 μ wide, mostly of the larger sizes, intraepidermal. Labia heavily carbonized, well arched, 30–35 μ wide, at least ¾ the length of the hysterothecium, lined inwardly with a white mass of filiform, nonseptate, gelatinized, hyaline periphyses 10–20 μ long. Basal layer a brown, translucent plate one cell thick composed of radiately arranged aliform hyphae. Cover well arched, carbonized heavily in the region of the labia and the margin, the intervening area less heavily carbonized and underlaid with several layers of brown pseudocollenchymatous cells, the outer layer definitely aliform and radial in disposition. Paraphyses hyaline, filamentous, straight or flexuous, clavately expanded for some distance at the tips and gelatinously fused into a white epithecium 10–15 μ thick, 70–100 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically rounded to subacute at the tips, tapered from near the base to a short, broad stipe, 55–90 μ long, 6.5–11 μ wide, 8-spored. Ascospores hyaline, nonseptate, filiform, straight or somewhat twisted with the ascus, fasciculate and arranged in pairs, of uniform diameter, 45–80 μ long by about 1 μ wide, incased in a thin and inconspicuous gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Not stated; presumably France.

Type specimen: Roumeguère, Fungi selecti exsiccati No. 6144.

Hosts: *Triticum hibernum:* France? (Roumeguère, exs.) ; *T. vulgare:* Ohio (Ellis and Everhart, 1892), Pennsylvania (Fulton, spec.), Italy (de Thuemen, exs.).

Exsiccati: Roumeguère, Fungi selecti exsiccati No. 6144; de Thuemen, Mycoth. univ. No. 661.

Specimen: H. R. Fulton, State College, Pa., May 23, 1908.

9. *Lophodermellina tumida* (Fries) von Höhnel

Hysterium tumidum Fries, Systema Mycologicum vol. 2, p. 591. 1823.
Coccomyces tumida Fuckel, Symbolae mycologici, p. 257, 1869. Not de Notaris, Giorn. Bot. Ital. 2 : 38. 1847.
Lophodermium tumidum Rehm, Rabenhorst's Kryptogamen Flora, vol. 3, p. 40. 1887.
Lophodermellina tumida von Höhnel, Ann. Mycol. 15 : 312. 1917.

Hysterothecia shining black, scattered and frequently crowded and contiguous in stramineous spots without black stromatic borders on leaves, very broadly elliptical, abruptly rounded at the ends, 420–1500 μ long, 300–1000 μ wide, intraepidermal. Labia heavily carbonized, about $\frac{2}{3}$ as long as the hysterothecium, 35–45 μ wide, up to 80 μ thick, lined inwardly by a white mass of short, septate, clavately enlarged, gelatinous and soon evanescent, hyaline periphyses 10–15 μ long and 2 μ wide. Basal layer a light brown, translucent plate 1 cell thick, composed of aliform, elongated, radially disposed cells. Cover usually heavily carbonized throughout, composed of an outer plate of aliform, radiately disposed but more or less meandering cells and, beneath this, a layer of pseudocollenchymatous cells 30–50 μ thick; the cover often breaking away entirely. Paraphyses hyaline, filamentous, straight or variously bent or crushed by pressure at the tips, not clavately enlarged, not exceeding the asci and forming no epithecium, 80–90 μ long, uniformly 2 μ wide. Asci cylindrical to broadly clavate, asymmetrically subacute at the tips, tapered below to a rather broad base, 70–90 μ long, 8–10 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 40–60 μ long, 2–2.5 μ wide, incased in a conspicuous gelatinous sheath 1.5–2 μ thick.

Imperfect stage: Leptostroma sorbicolum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 80. 1929.–Pycnidia minute, black, shining, 200–400 μ in diameter, with a thin excipulum of 1 or 2 layers of brown, aliform hyphae; ostiole up to 7 μ in diameter. Conidiophores sparingly branched, 10–15 μ long, 2 μ wide, bearing several spores at the apex. Conidia bacillar, straight, nonseptate, hyaline, 3–5 $\times$ 1 μ.

Type locality: Not given by Fries.

Type specimen: Fries, Scleromyceti Sueciae exsiccati No. 166.

Hosts: *Sorbus Aucuparia:* Switzerland and Austria (Rehm, 1887), Czechoslovakia (Hilitzer, 1929); *S. americana:* New Brunswick, Canada (Farlow, exs.).

Exsiccati: Rehm, Ascomyceten No. 519; Fuckel, Fungi rhen. No. 746; Reliquiae Farlow. No. 51.

Notes: Rehm (1887, p. 40) distinguished the variety Napelli, for which he gives as host *Aconitum Napellus*. I have not been able to see material of this, but supposed that it should be considered a separate species. Rehm describes the asci as being 105 μ long and the spores as 60–75 $\times$ 1.25 μ. Chevallier (1826) records *Lophodermium herbarum* on this host.

4. LOPHODERMINA von Höhnel (without description)

Berichte der Deutschen Botanischen Gesellschaft 35 : 418. 1917.

Ascomata in the form of hysterothecia, subrotund to elongate, flattened, immersed in the tissues of the host and inserted strictly between cuticle and epidermis, composed of separately developed bases and covers that are distinct at maturity and which possess plates of aliform mycelium forming the outer layer of the cover and the bottom layer of the base. Opening an elongated ostiole surrounded by thickened and more or less carbonized labia and lined with filiform, gelatinizing, persistent or evanescent periphyses. Hymenium consisting of both asci and paraphyses, disciform and strictly basal, arising from a closely interwoven, hyaline plectenchyma of fine hyphae. Paraphyses filamentous, nonseptate, unbranched. Asci cylindrical, asymmetrically rounded above, 4- or 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, incased in a more or less conspicuous hyaline gelatinous sheath.

Type species: *Lophodermina melaleuca* (Fries) von Höhnel, Ber. der Deutsch. Botan. Gesellsch. 35 : 422. 1917, and Ann. Mycol. 15 : 312. 1917.

KEY TO THE SPECIES OF LOPHODERMINA

Asci generally more than 125 μ long:
- Ascospores septate ..... 21. L. septata
- Ascospores not septate in the ascus:
  - Periphyses, in mass, and epithecium yellow; on Pinus ..... 7. L. conigena
  - Periphyses, in mass, and epithecium white; on Abies ..... 4. L. autumnalis

Asci generally less than 125 μ long:
- Asci generally 100 μ or more long:
  - Asci 4-spored; on Thuya ..... 22. L. Thuyae
  - Asci 8-spored:
    - Ascospores 2 μ or more wide:
      - Asci broad, up to 18 μ wide; on Juniperus ..... 11. L. juniperina
      - Asci slenderer, not over 14 μ wide:
        - On Pinus ..... 15. L. nitens
        - On Rhododendron ..... 20. L. Rhododendri
    - Ascospores 1.5–2 μ wide:
      - Gelatinous matrix 3–4 μ thick; on Abies ..... 23. L. uncinata
      - Gelatinous matrix about 1 μ thick:
        - Periphyses white in mass; on Larix ..... 12. L. laricina
        - Periphyses yellow in mass; on Pernetia ..... 6. L. clavuligera

Asci generally less than 100 μ long:
Ascospores broad, generally more than 1.5 μ wide:
Ascospores very broad, 2 μ or more wide; on Chamaedaphne..16. L. orbicularis
Ascospores more slender, 1.5–2 μ wide:
Periphyses, in mass, and epithecium yellow; on Vaccinium...14. L. melaleuca
Periphyses, in mass, and epithecium white:
Periphyses slender, 1–1.5 μ wide; on Marsipospermum.....2. L. antarctica
Periphyses coarser, 2–2.5 μ wide; on Vaccinium.....13. L. macularis
Ascospores more slender, generally less than 1.5 μ wide:
Ascospores 1–1.5 μ wide:
Periphyses, in mass, and epithecium yellow; on Gramineae...3. L. apiculata
Periphyses, in mass, and epithecium white; on Quercus, etc.....19. L. punctiformis
Ascospores very slender, 1 μ or less wide:
Periphyses, in mass, and epithecium yellow:
Paraphyses clavately expanded; ascospores 45 μ or more long; on Epilobium.....5. L. ciliata
Paraphyses not clavately expanded; ascospores less than 45 μ long; on Salix.....24. L. versicolor
Periphyses, in mass, or epithecium white
Paraphyses clavately expanded; on Cupressus....9. L. Cupressi-thyoidis
Paraphyses not clavately expanded:
Paraphyses longer than the asci, forming an epithecium:
Asci generally less than 50 μ long; on Kalmia.....10. L. exarida
Asci generally more than 50 μ long:
Asci broad, up to 9 μ wide; on Aira.....8. L. culmigena
Asci slender, up to 6 μ wide; on Planchonia.....1. L. Aleuritis
Paraphyses about equalling the asci, epithecium indefinite or absent:
Asci generally more than 50 μ long; on Prunus.....18. L. prunicola
Asci generally less than 50 μ long; on Paeonia.....17. L. Paeoniae

1. *Lophodermina Aleuritis* (Rehm) n. comb.

Plate IV, Figs. 13–15.

Lophodermium Aleuritis Rehm, Leafl. Philippine Bot. 6 : 2232. 1914.
Lophodermium Planchoniae Rehm, Leafl. Philippine Bot. 8 : 2925. 1914.

Hysterothecia shining black, amphigenous and scattered in light stramineous, extensive, irregular spots 2–4 mm. in diameter and delimited by fine, black, stromatic lines, short to long elliptical or linear, straight or curved and lunate, 375–600 μ long, 180–350 μ wide, subcuticular. Labia heavily carbonized, tending to become extroverted, nearly as long as the hysterothecia, 20–35 μ wide; lined inwardly by a shining white mass of gelatinizing, clavately enlarged, persistent periphyses 5–15 μ long and 1–1.5 μ wide. Basal layer a brown, translucent plate one cell thick, sometimes thickened toward the middle by the apposition, above, of one or two layers of pseudoparenchyma, consisting of radiately disposed aliform plectenchyma; this overlaid to a depth of 5–20 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized and opaque in the region of the labia, elsewhere brown and more or less translucent, consisting of an outer plate of heavily chytinized, radiately disposed, aliform hyphae

which extend at the margin to a distance of 10–50 μ beyond the margin of the base, this thickened by the apposition, beneath, of several layers of pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded above but variously bent or crushed by pressure and gelatinously coalesced into a shining white epithecium 10–12 μ thick, 80–110 μ long, 0.75–1 μ wide. Asci cylindrical to subclavate, asymmetrically and bluntly rounded above, tapered from below the middle to a broad stipe, 60–80 μ long, 4.5–6 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, twisted or intricately coiled within the ascus, 45–70 μ long, 0.75–1 μ wide, incased in an inconspicuous gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Mount Maquiling, near Los Baños, Province of Laguna, Philippine Islands.

Type specimen: C. F. Baker No. 2076. Luzon, Prov. Laguna. 11/1913. *Leg.* S. A. Reyes.

Hosts: *Aleurites moluccana:* Philippine Islands (Rehm, 1914); *Planchonia spectabilis:* Philippine Islands (Rehm, 1916; Baker, 1931, exs.); dead leaves: Philippine Islands (Rehm, 1914; Baker, 1931, exs.).

Exsiccati: Baker, Fungi Malayana, Nos. 154, 156.

Note: The specimen labeled *Lophodermium Aleuritis* Rehm in Baker's exsiccatum, No. 154, is identical in all respects, even to host, with *L. Planchoniae.* Baker's exsiccatum No. 154 gives the host only as "dead leaves." Since the species name, *Aleuritis,* has precedence because of earlier publication, I have chosen to reduce the later name to synonomy, though realizing the danger of a misconception of the host relationship.

2. *Lophodermina antarctica* (Spegazzini) n. comb.

Plate V, Fig. 4.

Lophodermium antarcticum Spegazzini, Fungi Fuegiani No. 304. 1887. In Bol. Acad. Nac. Cienc. Cordoba 11 : 135-311. 1887.

Hysterothecia shining black, arranged with the long axis parallel with the stem axis, scattered in small, poorly defined, not delimited, light stramineous areas on stems, broadly elliptical to subrotund, 660–940 μ long, 375–625 μ wide, subcuticular. Labia indistinct, much arched but not extroverted, heavily carbonized and opaque, 50–70 μ wide in the center, tapering towards both ends, up to 35 μ thick, lined inwardly at first by a white mass of hyaline, gelatinously agglutinating and very soon evanescent, clavately expanded periphyses 6–10 μ long by 1–1.5 μ wide. Cover hemispherical, carbonized and opaque except at the margin, which extends as a loosely constructed, erose skirt of brown, prosenchymatic, aliformly terminated hyphae to a distance of 40 to 70 μ beyond the base. Basal layer a plate one cell thick of dark brown, radiately

disposed, aliform prosenchyma; this overlaid to a depth of 5 to 12 μ by a closely interwoven, hyaline plectenchyma from which the hymenium arises. Paraphyses filamentous, hyaline, straight or flexuous, not clavately expanded but variously crushed and bent at the tips and gelatinously agglutinated above the asci into a white epithecium 10–20 μ thick, 70–100 μ long, 1–1.5 μ wide. Asci cylindrical, asymmetrical and abruptly rounded to truncate at the tips, tapered near the base to a short, broad stipe, 65–80 μ long, 8–10 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 45–60 μ long, 1.5–2 μ wide, incased in a conspicuous, hyaline, gelatinous sheath 1.2–2 μ thick.

Type locality: Staten Island, Tierra del Fuego.

Type specimen: No. 1010 in Herbario Spegazzini, Museo de La Plata.

Host: *Marsipospermum* sp. : Staten Island, Tierra del Fuego (Spegazzini, spec.).

Specimen examined: The type.

3. *Lophodermina apiculata* (Wormsk. *ex* Fries) n. comb.

Plate IV, Fig. 7.

Hysterium apiculatum Wormsk. ex Fries, Systema Mycologicum, vol. 2, p. 593. 1823.

Lophodermium arundinaceum γ *apiculatum* Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 59. 1861.

Lophodermium apiculatum Duby, in Saccardo, Sylloge Fungorum 2 : 797. 1883.

Lophodermium arundinaceum f. *apiculatum* Rehm, in Rabenhorst's Kryptogamen Flora, vol. 3, p. 46. 1887.

Hysterium Actinothyrium Fuckel, Symbolae Mycologicae, Nacht. III, p. 28, 1877.

Lophodermium arundinaceum var. *Actinothyrium* Rehm, in Rabenhorst's Kryptogamen Flora, vol. 3, p. 47. 1887.

Hysterothecia dull black, scattered in light stramineous spots of various extent in arid leaves, arranged in rows between and oriented parallel with veins, broadly to narrowly elliptical, often with ends pointed and extended subcuticularly into tapered and acute mycelial mucrons, 225–750 μ long, 210–300 μ wide, subcuticular. Labia prominent, heavily carbonized, up to 35 μ wide, 15–35 μ thick, turning outward and at first presenting a shining white mass of periphyses, these soon evanescent, gelatinously agglutinated, 2–3 μ wide and 15–25 μ long. Basal layer about 1 cell thick (2–3 cells thick at the margins), composed of pseudoparenchymatous, brown, translucent hyphae aliform at the margins; this overlaid to a depth of 5–10 μ by a finely interwoven layer of hyaline plectenchyma. Cover somewhat carbonized at the margins, elsewhere brown and more or less translucent, not apparently aliform except at the margin, where definitely aliform cells mark the edge of the cover. Paraphyses filamentous, straight or variously bent and crushed at the tips,

somewhat swollen and club-shaped at the tips, and united by gelatinization into a heavy, shining-white to yellowish epithecium about 5 μ thick, about 1 μ wide, up to 85 μ long. Asci cylindrical, obtuse to subacute and asymmetrical at the tips, somewhat tapered from below the middle to a short, narrow stipe, 45–80 μ long, 6.5–10 μ wide, 8-spored. Ascospores filiform, hyaline, non-septate, fasciculate and arranged in pairs, 40–75 μ long, 1–1.5 μ wide, incased in a thin, hyaline, gelatinous matrix, sometimes straight but usually with one marked twist near the top of the ascus.

Imperfect stage: Actinothyrium graminis Kunze, according to Rehm (1887). Spores filiform, curved, hyaline, 50×1 μ.

Type locality: Kamchatka (Fries, 1823).

Type specimen: Not specified; Fries cites no specimen.

Hosts: Undetermined grasses: Kamchatka (Fries, 1823); *Calamagrostis arundinacea:* Czechoslovakia (Hilitzer, 1929), Germany (Sydow, *exs.*); *C. sylvaticum:* Germany (de Thuemen, *exs.*); *C. epigeios:* Czechoslovakia (Hilitzer, 1929); *C. villosa:* Czechoslovakia (Hilitzer, 1929); *C. canadensis:* Colorado (Clements *exs.*); *Molinia coerulea:* Germany (Rehm, 1896; Sydow, *exs.*, Switzerland (Kunze, *exs.*).

Exsiccati: Kunze, Fungi selecti No. 372; de Thuemen, Mycoth. univ. No. 471; Rehm, Ascomyceten No. 775; Sydow, Mycoth. germ. No. 81, No. 897; Clements, Crypt. Format. Colo. No. 48.

Illustrations: Corda, Icones Fungorum vol. 5, pl. 9, fig. 58. 1842.

Remarks: The distinction upon which this species was based is the remarkable, tapering, pointed ends of the hysterothecia. This, however, is a character not uniformly developed, and is to be found in various degrees of development or may be entirely absent, both on Calamagrostis and on *Molinea coerulea.* Fries (1823) notes, " . . . *sed distinctissimum mucrone, qui vero in junioribus non distinguitur*" but in the material that we have examined even completely mature and empty hysterothecia lack the apical points while others, taken only a few millimeters away on the same host material, possess it to a very marked extent. It is present on both host genera, and since the fungi on the two hosts are not distinct otherwise, we have united the two species under the earlier name.

4. *Lophodermina autumnalis* (Darker) n. comb.

Plate I, Fig. 9.

Lophodermium autumnale Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : 77. 1932.

Hysterothecia shining black, occurring on needles primarily attacked by nervisequious Hypodermataceae, scattered or crowded and frequently becoming confluent, elliptical, 400–800 μ long, 270–420 μ wide, 150–300 μ

deep, subcuticular. Labia indefinite, not greatly thickened or markedly carbonized, lined inwardly by a white mass of filiform, clavately expanded, soon evanescent, hyaline periphyses up to 20 μ long and 1.5–2 μ wide. Basal layer a very loosely compacted plate of radiately disposed brown, translucent, aliform, meandering prosenchyma; this overlaid to a depth of 15–25 μ by a closely interwoven, columnar, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover well arched, brown and more or less translucent, composed of an outer plate of heavily chytinized, meandering, aliform hyphae which extend outward at the margin to as much as 20 μ beyond the margin of the base, this thickened by the apposition beneath of pseudocollenchyma to a thickness of 50 μ in the region of the labia. Paraphyses hyaline, filamentous, straight or flexuous, very slightly clavately expanded at the tips, 130–160 μ long, not exceeding the asci in length and forming no epithecium, about 1 μ wide. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered to a rather broad, short stipe, 110–160 μ long, 12–15 μ wide; 8-spored. Ascospores filiform, hyaline, nonseptate, straight or somewhat twisted with the ascus, fasciculate and arranged in pairs, 80–100 μ long, 1.5–2 μ wide, incased in a gelatinous matrix 3–5 μ thick.

Imperfect stage: Unknown.

Type locality: Claude Lake, Gaspe County, Quebec, Canada.

Type specimen: J. H. Faull, No. 8748, collected Sept. 1928.

Hosts: *Abies amabilis:* Oregon (Darker, 1932); *A. balsamea:* Michigan, Nova Scotia, Ontario, and Quebec (Darker, 1932); *A. concolor:* California (Boyce, spec.), Oregon (Darker, 1932); *A. lasiocarpa:* Idaho (Darker, 1932), Utah (Korstian, spec.), Wyoming (Weir, No. 9169; Sydow and Petrak, 1922); *A. magnifica:* California (Boyce, spec.); *A. nobilis;* Oregon (Darker, 1932).

Specimens: Boyce, Weaver Bally Mt., Cal., June 22, 1914; Korstian, Ephraim, Utah, Sept. 4, 1918; Boyce, Hyampton, Cal., June 12, 1914.

Illustrations: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 21, figs. 1–5. 1932.

5. *Lophodermina ciliata* (Libert) n. comb.

Hysterium ciliatum Libert, in herb., according to Roumeguère and Saccardo, Rev. Mycol. 3 : 39. 1881.

Lophodermium ciliatum Spegazzini and Roumeguère, Rev. Mycol. 3 : 39. 1881.

Hysterothecia dull to shining black, scattered in dead, stramineous areas on stems, very broadly oval, 450–825 μ long, 225–475 μ wide, subcuticular. Labia carbonized, becoming extroverted, nearly as long as the hysterothecia, 20–40 μ wide, lined inwardly by a yellow mass of gelatinous, clavately expanded, persistent periphyses up to 25 μ long and

1–1.5 μ wide. Basal layer a brown, translucent plate of radiately disposed, aliform hyphae thickened in the middle by the apposition, above, of about three layers of brown pseudoparenchyma; this overlaid to a depth of 10–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover well rounded, carbonized in the vicinity of the labia, elsewhere more or less translucent, consisting of an outer plate of radiately disposed aliform mycelium thickened by the apposition, beneath, of several layers of pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, clavately expanded at the tips and there incased in a gelatinous sheath by which they are agglutinated into a thick, firm, orange-yellow epithecium, 50–90 μ long, 0.75–1 μ wide. Asci narrowly cylindrical to subclavate, asymmetrically subacute at the tips, tapered from below the middle to a fine stipe, 50–80 μ long, 6–8 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 45–70 μ long, 0.75–1 μ wide, gelatinous matrix inconspicuous.

Imperfect stage: Unknown.

Type locality: Malmedy, Belgium.

Type specimen: Roumeguère, Fungi Selecti Gallici Exsiccati No. 662.

Host: *Epilobium angustifolium:* Belgium (Roumeguère, exs.).

Exsiccati: Roumeguère, Fungi sel. Gall. exs. No. 662, "Add caules *Epilobii angustifolii,* prope Malmedyanum, Vere *Reliquiae Libertianae.*"

Notes: The type specimen, as distributed by Roumeguère and available to me, is in very poor condition, the shape of the hysterothecia, their mycelial structure, and rarely an ascus with paraphyses, being all that is visible. The original diagnosis cannot be greatly improved upon, though it is evident that the marginal cilia required in that description are only the epidermal hairs of the host.

6. *Lophodermina clavuligera* (Spegazzini) n. comb.

Plate V, Fig. 6.

Lophodermium clavuligerum Speg., Fungi. Fuegiani No. 305. 1887. In Bol. Acad. Nac. Cienc. Cordoba 11 : 135–311. 1887.

Hysterothecia dull black, amphigenous, in indistinct areas delimited by black, stromatic lines, broadly elliptical to subrotund, with rounded ends, 500–850 μ long, 400–625 μ wide, subcuticular. Labia indistinct and but little raised, not extroverted in age, 25–50 μ wide, 15–20 μ thick, lined inwardly by a yellow mass of clavate, short, gelatinous and very soon evanescent periphyses 6–12 μ long by 1.5–2 μ wide. Cover somewhat arched, carbonized in the region of the labia, elsewhere dark brown and somewhat translucent, composed of an outer plate of meandering,

aliform mycelium underlaid by brown pseudocollenchyma. Basal layer a plate of brown, radiately disposed, meandering aliform prosenchyma thickened, upward, by the apposition of one or two layers of brown pseudoparenchyma; this overlaid to a depth of 12–18 μ by a closely interwoven, yellowish plectenchyma of fine hyphae from which the hymenium arises. Paraphyses filamentous, yellow in mass, straight or flexuous, clavately expanded at the tips and agglutinated about the ascus-tips into a thin, readily dissolved, yellow epithecium. Asci cylindrical to slightly clavate, bluntly and asymmetrically round above, tapered from the middle to a broad base, 100–110 μ long, 6–7.5 μ wide, 8-spored. Ascospores hyaline, filiform, septate, yellow-tinted in mass, straight or twisted with the ascus, 85–100 μ long, 1–1.5 μ wide, gelatinous matrix inconspicuous.

Type locality: Staten Island, Tierra del Fuego.

Type specimen: "Herbario Spegazzini" No. 1006 (Museo de la Plata).

Host: *Pernettia mucronata*: Staten Island (Spegazzini, spec.).

Specimen examined: The type.

Notes: The type specimen, which is the only record of this fungus that I have been able to find, is very scant. It consists of 4 small host leaves with a few hysterothecia on each. Characters of the hymenium are no longer determinable; but on the packet containing the specimen Spegazzini has made his characteristically fine, pencil drawings showing the shape of the paraphyses, asci, and spores, dimensions being noted for each of these structures. The items indicated by his drawings and notes furnish the material upon which the above description of paraphyses, asci, and spores is based.

7. *Lophodermina conigena* (Brunaud) n. comb.

Lophodermium pinastri f. *conigena* P. Brunaud, Act. de la Soc. Linn. de Bordeaux 42 : 97. 1888.

Lophodermium conigenum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 76. 1929.

Hysterothecia shining black, irregularly scattered over scales of cones, elliptical with obtusely rounded ends, 1500–2000 μ long, 800–1000 μ wide, subcuticular. Labia narrow, eventually extroverted, heavily carbonized, 70–100 μ wide, up to 45 μ thick, lined inwardly with a yellow mass of gelatinizing, more or less persistent, clavately expanded periphyses 15–35 μ long and 1.5–2 μ wide. Basal layer a dark brown, more or less translucent plate of radiately disposed aliform plectenchyma thickened by the apposition, above, of one to several layers of brown pseudoparenchyma; this overlaid to a depth of 25 μ by a closely interwoven,

hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized near the margins and in the region of the labia, in the intervening area more or less translucent, consisting of an outer plate of radiately disposed aliform plectenchyma thickened by the apposition to varying depths of brown pseudocollenchyma, extending outward at the margin 5–30 μ beyond the margin of the base. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded but bent and crushed at the tips, 150–200 μ long, about 1.5 μ wide, gelatinously agglutinated above the asci and forming a white epithecium up to 20 μ thick. Asci cylindrical to long-clavate, asymmetrically conical and obtuse at the tips, tapered to a broad stipe, 130–180 μ long, 12–14 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, fasciculate and arranged in pairs, straight or coiled in the ascus, 100–150 μ long, 1.5–2 μ wide, incased in a hyaline, gelatinous matrix 1.5–2 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Brunaud.

Type specimens: Not designated by Brunaud.

Hosts: *Pinus sylvestris:* France (Brunaud, 1888); *P. uliginosa:* Czechoslovakia (Hilitzer, 1929).

Illustrations: Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : pl. 4, fig. 18. 1929.

8. *Lophodermina culmigena* (Fries) von Höhnel

Plate IV, Figs. 1–4.

Hysterium culmigenum Fries, K. Vet. Akad. Handl. 38 : 96. 1817; Observ. mycol. praecip. ad illustr. floram Suec., pt. 2, p. 355. 1818; Systema Mycologicum, vol. 2, p. 591. 1823.

Lophodermium arundinaceum δ *culmigenum* Fuckel, Jahrb. d. Nassauischen Ver. f. Naturk. 23/24 : 257. 1869/70.

Lophodermium culmigenum Karsten, Ofvers. af Kongl. Vetensk.-Akad. Forh. 2 : No. 28. 1872.

Lophodermina culmigena von Höhnel, Ann. Mycol. 15 : 313. 1917.

Hysterothecia dull to shining black, in light stramineous extensive areas on culms, sheaths, and leaves, arranged in rows between and oriented parallel with veins and strands of sclerenchyma, narrowly to broadly elliptical with truncate ends from which cylindrical hyphae straggle out loosely between epidermis and cuticle, 450–1100 μ long, 225–400 μ wide, subcuticular. Labia prominent, heavily carbonized, 50–70 μ wide, up to 60 μ thick, extroverted in age, lined inwardly with a white mass of clavately expanded, gelatinous and soon evanescent, hyaline periphyses 10–18 μ long by 1–1.5 μ wide. Basal layer a brown, translucent plate of radiately disposed aliform prosenchyma thickened toward the middle by the apposition, above, of two to four layers of

brown pseudoparenchyma; this overlaid to a depth of 10–35 μ by a closely interwoven hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover tending to become heavily carbonized with age, consisting of an outer plate of heavily chytinized aliform mycelium which extends outward at the margin 10–50 μ beyond the margin of the base and is aliformly terminated along the sides but not at the ends of the hysterothecium. Paraphyses hyaline, filiform, straight or flexuous, not clavately expanded and but little crushed or bent by pressure, 50–100 μ long, gelatinously coalesced at the tips into a thin, fragile, easily dissolved, white epithecium. Asci cylindrical to subclavate, asymmetrically subacute at the tips, somewhat tapered near the base to a short, broad stipe, 45–90 μ long, 5–9 μ wide, 8-spored. Ascospores hyaline, nonseptate, filiform, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 45–75 μ long, 1 μ wide, incased in a more or less conspicuous gelatinous matrix up to 1.5 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: Not specified; Fries (1823) cites Scleromyceti Sueciae exsiccati No. 97.

Hosts: *Elymus arenarius* (Fries, 1823); *Aira flexuosa:* Sweden (?Fries, 1823), Kamchatka (?Fries, 1823); Germany (Sydow, exs.), France (Roumeguère, exs.).

Exsiccati: Roumeguère, Fungi sel. exs. No. 7043; Sydow, Mycoth. Germ. Nos. 1599, 2147.

Illustrations: Fries, Observ. mycol. praecip. ad illustr. floram Suec., pt. 2, pl. 7, fig. 3. 1818.

9. *Lophodermina Cupressi-thyoïdis* (Saccardo) n. comb.

Lophodermium juniperinum f. *Cupressi-thyoidis* Saccardo, Michelia 2 : 570. 1882.

Hysterothecia shining black, on scale leaves at the tips of dead twigs, elliptical, with ends rounded, 450–650 μ long, 270–330 μ wide, subcuticular, placed on one or the other side of the central nerve of the scale, usually only one on each scale, rarely two. Labia poorly defined and very little carbonized, not greatly thickened and distinguishable only by sectioning, ⅔–¾ the length of the hysterothecium, not opening widely, lined within by a white mass of gelatinizing, soon evanescent, hyaline periphyses 5–12 μ long, 1–1.5 μ wide. Basal layer a brown, translucent plate one cell thick of radiately disposed aliform prosenchyma; this overlaid to a depth of but 1–3 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover but very little carbonized, brown and translucent, consisting of an outer plate of dichotomous, aliform plectenchyma thickened by the apposition beneath

of one to several layers of slightly colored pseudoparenchyma, extending 10–20 μ beyond the margin of the base. Paraphyses hyaline, filamentous, straight or flexuous, simple, clavately expanded at the tips and there gelatinously coalesced in a thin, hyaline epithecium, 50–95 μ long, 1.5–2 μ wide. Asci cylindric to subclavate, asymmetrically subacute or rounded at the tips, tapering from below the middle to a very fine stipe, 65–90 μ long, 6.5–8 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 44–60 μ long, 0.75–1 μ wide, incased in a hyaline, gelatinous matrix 1–1.5 μ wide.

Imperfect stage: Unknown.

Type locality: Newfield, New Jersey.

Type specimen: Ellis, North American Fungi No. 999 b.

Host: *Chamaecyparis thyoides:* New Jersey (Ellis, exs., 1892).

Exsiccati: Ellis, North American Fungi No. 999 b. (type).

Notes: Darker (1932) has, apparently following Saccardo, included this fungus under *Lophodermium juniperinum.* He lists Saccardo's name for it as a synonym, and in his host list gives *Chamaecyparis thyoides* in New Jersey. Presumably this is on the authority of either Ellis and Everhart (1892) or Saccardo (1882), as there is no indication in his list of exsiccati or specimens examined that he has seen the Ellis specimen, which is, of course, to be regarded as the type upon which Saccardo based his name.

Upon comparison of actual material, there seems to be no reason for regarding the forms on Juniperus and Chamaecyparis as identical, or even as variants of the same species. While both are subcuticular in location with respect to the host and very definitely composed outwardly of aliform mycelium, they have in other ways decided differences. The most easily observed of these is the contrast in carbonization and thickening of the hysterothecia and hysterothecial labia. In the form on Chamaecyparis, the asci fail by 20 μ of reaching the shortest of those on Juniperus, the spores are neither so long nor so wide, the asci not so wide, and the paraphyses far less wide.

10. *Lophodermina exarida* (Cooke & Peck) n. comb.

Hysterium exaridum Cooke & Peck, Twenty-ninth Report, N. Y. State Museum, 1875: 63. 1878, and Cook & Peck, Bull. Buffalo Soc. Nat. Sci., 1875: pt. 3, p. 36. 1875.

Lophodermium exaridum Saccardo, Sylloge Fungorum, vol. 2, p. 792. 1883.

Hysterothecia shining black, amphigenous and usually within 1–2 mm. of the margins of extensive, brown, irregular spots sharply delimited by very fine, black, stromatic lines, elliptical, 270–825 μ long, 210–425 μ

wide, subcuticular. Labia prominent, well arched, extroverted at maturity, carbonized through about ½ their length at their middles, almost as long as the hysterothecia, 35–60 μ wide, lined inwardly by a white mass of hyaline, clavately expanded, gelatinously agglutinated periphyses 5–12 μ long by about 1 μ wide. Basal layer a brown, translucent plate one cell thick, consisting of radiately disposed aliform prosenchyma, this overlaid to a depth of 2–5 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover but little carbonized, consisting of an outer plate of chytinized, translucent, aliform mycelium thickened variably by the apposition, beneath, of pseudoparenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, not clavately enlarged but much bent and crushed by pressure and gelatinously united into a very thin (3 μ thick) white epithecium, 35–50 μ long, 0.75–1 μ wide. Asci cylindrical to subclavate, asymmetrically rounded or abruptly subacute at the tips, tapered from above the middle to a fine stipe, 35–50 μ long, 6–9 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, 33–40 μ long, 0.75–1 μ wide, incased in a hyaline, gelatinous matrix 1–1.5 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Peck (1878).

Type specimen: Not cited by Peck (1878).

Hosts: *Kalmia angustifolia:* New York (Cooke 1875, Peck 1878), New Hampshire: (Farlow, exs.); *Kalmia latifolia:* New Jersey (Ellis, exs., 1892).

Exsiccati: Ellis, North Am. Fungi No. 998; Reliquiae Farlowianae No. 47.

11. *Lophodermina juniperina* (Fries) n. comb.

Plate II, Fig. 6; Plate III, Fig. 14; Plate IV, Figs. 5, 6.

Hysterium juniperinum Fries, Observ. mycol. praecip. ad illustr. floram Suec., pt. 2, p. 355. 1818.
Hysterium pinastri β juniperinum Fries, Systema mycologicum vol. 2, p. 588. 1823.
Hysterium Juniperi Greville, Scottish Cryptogamic Flora, vol. 1, pl. 26. 1823.
Lophodermium juniperinum de Notaris, Giorn. Bot. Ital. 2 : 6. 1847.
Lophodermium Sabinae Fautrey, Rev. Mycol. 13 : 169. 1891.

Hysterothecia shining black, scattered, amphigenous but especially on the upper faces of leaves, elliptical, often truncate at the ends, 350–900 μ long, 250–450 μ wide, 150–170 μ high, subcuticular. Labia on most hosts and in old material much thickened and carbonized, on some hosts (*Juniperus communis*) hardly differentiated, lined inwardly by a white mass of clavately enlarged, gelatinizing and soon evanescent periphyses 7–15 μ long, 1.5–2 μ thick. Basal layer a light brown, translucent plate one cell thick of radiately disposed, dichotomously divided aliform plectenchyma; this overlaid to a depth of 5–10 μ by a closely interwoven,

hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover brown and translucent to heavily carbonized and opaque, consisting of an outer, dichotomous, aliform plate heavily chytinized and extending at the margin as much as 30 μ beyond the margin of the base, thickened to as much as 50 μ by the apposition, beneath, of pseudocollenchymatous cells. Paraphyses hyaline, filiform, much bent at the tips by pressure, clavately expanded at the tips, agglutinated above the asci into a compact, white epithecium 10–20 μ thick, up to 150 μ long, 1.5 μ wide. Asci cylindrical to subclavate, asymmetrically acute to subacute at the tips, tapered from somewhat above the middle to a broad or fine stipe, 100–130 μ long; 10–17 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, of uniform diameter, fasciculate and arranged in pairs, often multiguttulate, 60–100 μ long, 2–3 μ wide, incased in a conspicuous, hyaline, gelatinous matrix up to 3 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: Not cited by Fries.

Hosts: *Chamaecyparis* sp. : Germany (Darker, 1932) ; *Juniperus* sp. : Ireland (Greville, 1823) ; *J. chinensis* var. *Sargenti:* Massachusetts (Darker, 1932) ; *J. communis:* Colorado (Clements, exs.), Iowa (Ellis & Everhart, 1892), Michigan (Hansen, spec.), New York, Washington, and Maine (Darker, 1932), Austria (de Thuemen, exs.), Belgium (Darker, 1932), Czechoslovakia (Hilitzer, 1929), England (Berkeley, exs.), France (Roumeguère, exs.), Germany (Jaap, 1914; Sydow, exs.), Italy (de Notaris, 1847), Scotland (Greville, 1823), Switzerland (Jaap, 1907) ; var. *depressa:* Maine, Massachusetts, New Hampshire, and Ontario (Darker, 1932) ; *J. horizontalis:* Massachusetts, Ontario (Darker, 1932) ; *J. Sabina:* Denmark (Lind, 1913), France, Poland, Switzerland (Darker, 1932), Germany (Jaap, 1916) ; *J. squamata:* Denmark (Lind, 1913) ; *J. oxycedrus:* Austria (Jaap, 1916) ; *J. virginiana:* Massachusetts, New York, Ontario (Darker, 1932), Denmark (Lind, 1913). *Libocedrus decurrens:* California (Darker, 1932), Oregon (Darker, 1932; Zeller, 1927).

Exsiccati: Clements, Crypt. Format. Colo. No. 50; Ellis, N. Am. Fungi No. 999 a; Krypt, exsic. ed. u Museo Palat. Vindob. No. 2220; Rehm, Ascomyceten No. 128; Roumeguère, Fungi Gall. sel. exs. No. 1870; Roumeguère, Fungi. sel. exs. No. 5863; Reliquiae Farlowianae (Fungi) No. 48; Sydow, Mycoth. Germ. No. 1600; de Thuemen, Fungi austriaci No. 1268; de Thuemen Mycoth. univ. No. 76.

Specimen: A. A. Hansen, Calumet, Mich., Aug. 8, 1916.

Illustrations: Greville, Scott. Crypt. Flora, vol. 1, pl. 26, figs. 1–4. 1823; Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 15,

fig. 4. 1929; Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 17, figs. 1–7. 1932.

Notes: In No. 3545 of Roumeguère's Fungi Gallici exsiccati, distributed as *Lophodermium juniperinum* f. *minor* Roumeguère on leaves of *Juniperus communis*, the package available to us contains a grass (Panicum sp.) upon which no Lophodermium is present. The validity of the form could not be determined.

12. *Lophodermina laricina* (Duby) n. comb.

Lophodermium laricinum Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 58, 1861.

Hysterothecia shining black, occurring singly or in pairs in sections of needles delimited by black, stromatic lines along which the needles break readily, amphigenous, subcuticular, elliptical, well arched, 450–680 μ long, 210–430 μ wide, subcuticular. Basal layer a brown, translucent plate one to three cells thick of compact, radially disposed aliform prosenchyma; this overlaid to a depth of 15–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover a plate of dark brown, heavily chytinized and nearly opaque, dichotomously branched aliform hyphae thickened by the apposition, beneath, to a depth of 20–50 μ of pseudocollenchymatous cells. Labia strongly carbonized, 80–85 μ wide, up to 450 μ long, up to 50 μ thick, lined inwardly by a white mass of clavately expanded, gelatinizing and soon evanescent hyaline periphyses 12–30 μ long and 1–1.5 μ wide. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded, much bent and crushed at the tips by pressure but not exceeding the asci in height and forming no epithecium, 100–120 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically blunt or subacute at the tips, tapered very slightly to a broad base, 95–135 μ long, 12–15 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, straight or intricately coiled within the ascus, fasciculate and arranged in pairs, 85–130 μ long, 1.5–2 μ wide, incased in a hyaline, gelatinous sheath about 1 μ thick.

Imperfect form: *Leptostroma laricinum* Fuckel, Jarhb. d. Nassauischen Ver. f. Naturk. 23/24 : 256. 1869/70. Pycnidia subcuticular, the cover and base of very fine aliform mycelium, round to elliptic, brown, translucent, 110–200 μ long by 80–160 μ, shining black. Conidia hyaline, nonseptate, bacilliform, 4–5 μ long, 0.5–1 μ wide.

Type locality: *"Ad radices orientales Alpium Pedemontii,"* as stated by Duby (1861).

Type specimen: Not designated.

Hosts: *Larix* sp. : Japan (Shirai and Hara, 1927), Austria (Jaap, 1916) ; *L. decidua:* Austria (Jaap, 1916), Italy (Saccardo, exs.), Switzerland (Darker, 1932) ; *L. laricina:* Ontario, Quebec (Darker, 1932).

Exsiccati: Fuckel, Fungi rhen. No. 743; Rabenhorst, Fungi europ. No. 158; Rehm, Ascomyceten, No. 1751; Saccardo, Mycoth. Ital. No. 505. The imperfect form is exemplified in Fuckel, Fungi rhen. No. 196 and Sydow, Mycoth. March. No. 4768.

Illustration: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 20, figs. 4–9. 1932; von Tubeuf, Arb. Biol. Abth. Forst.-u. Landw. Kaiserl. Gesundh. 2 : pl. 3, figs. 11–19. 1901.

13. *Lophodermina maculare* (Fries) n. comb.

Plate IV, Figs. 8–11.

Hysterium maculare Fries, Systema Mycologicum, vol. 2, p. 592. 1823.
Lophodermium maculare de Notaris, Giorn. Bot. Ital. 2 : 40. 1847.
?Lophodermium maculare var. *albolabrum* Ellis and Everhart, The North American Pyrenomycetes, p. 859. 1892.
Lophodermium maculare var. *Arctostapyli* Rehm, Ber. Bayer. Bot. Gesellsch. 13 : 16. 1912.

Hysterothecia dull or shining black, amphigenous, solitary or several in white, irregularly angular, papery spots delimited very sharply from the surrounding brown leaf tissue by fine black, stromatic lines, nearly circular to broadly elliptical with rounded ends, well arched, 345–700 × 230–420 μ, subcuticular. Labia prominent and becoming extroverted, about ¾ the length of the hysterothecium, heavily carbonized, 30–50 μ wide, lined inwardly by a prominent, white mass of filiform, clavately expanded, nonseptate, gelatinously agglutinated, hyaline periphyses 20–30 μ long and 2–2.5 μ wide. Cover well arched, more or less translucent, thin at the edges, up to 50 μ thick at the labia, consisting of an outer plate of dichotomously branched aliform hyphae thickened by the apposition, below, of subcarbonaceous pseudocollenchyma. Basal layer a brown, translucent plate one to three cells thick of radiately disposed plectenchyma, the outer layer aliform; this overlaid to a depth of 10–15 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Paraphyses hyaline, filamentous, straight or flexuous, bent by pressure at the tips but not enlarged or swollen, gelatinously agglutinated and forming a dense, white epithecium up to 25 μ thick, 90–135 μ long, 1–1.5 μ wide. Asci cylindrical, bluntly and asymmetrically rounded at the tips, tapered near the base to a short, narrow stipe, 60 × 9 to 120 × 14 μ, 8-spored. Ascospores hyaline, filiform, nonseptate, of uniform diameter, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 55–95 μ long, 1.5–2 μ wide, incased in a hyaline, gelatinous matrix 1–1.5 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: Fries, Scleromyceti Sueciae exsiccati No. 167.

Hosts: *Arctostaphylos* sp. : Oregon (Zeller, sp.); *A. uva-ursae:* Germany (Rehm, 1912); "Quaking Ash" : Utah (Ellis, exs.); *Vaccinium ovatum:* Oregon (Zeller, 1927); *V. pennsylvanicum* (de Thuemen, exs.); *V. uliginosum:* Germany and France (Duby, 1861), Sweden (Fries, 1823).

Exsiccati: Ellis, North Amer. Fungi. No. 859; Roumeguère, Fungi selecti Gallici No. 553; Sydow, Mycoth. German. No. 2146; de Thuemen, Mycoth. univ. No. 75.–Rehm (1887) also cites Fuckel, Fungi rhen. No. 1752, and Mougeot & Nestler, Stirp. Crypt. No. 1072.

Specimen: S. M. Zeller, Rhododendron, Ore., July 6, 1929. No. 8989.

Notes: The example distributed in Ravanel's Fungi americani exsiccati, No. 179, on Quercus sp. (Q. Phellos L.?) is not a Lophodermina. The hysterothecia are intraepidermal and possess decidedly clavate, long stalked asci. The spores are 1-celled, somewhat curved, hyaline, 17–20 × 4–4.5 μ. The specimen is referable to Hypoderma.

Ellis and Everhart's variety *albolabrum,* based on the "Quaking Ash" specimen, is not different from the species. They did not distinguish correctly between *L. maculare,* which has white periphyses, and *L. melaleucum,* which has yellow periphyses.

14. *Lophodermina melaleuca* (Fries) von Höhnel

Hysterium melaleucum Fries, Observ. mycol. praecip. ad illustr. floram Suec., pt. 1, p. 192. 1815; K. Vet. Akad. Handl. 40 : 96. 1819; Systema Mycologicum, vol. 2, p. 589. 1823.

B *Hysterium pulchellum* Fries, Systema Mycologicum, vol. 2, p. 589. 1823.

Lophodermium melaleucum de Notaris, Giorn. Bot. Ital. 2 : 40. 1847.

Lophodermium melaleucum var. *aureo-marginatum* Stärback, Bot. Not. 1899. p. 159.

Lophodermium melaleucum var. *epiphyllum* Zeller, Mycologia 24 : 293. 1934.

Lophodermina melaleuca von Höhnel, Ber. der Deutsch. Bot. Gesellsch. 35 : 422. 1917, and Ann. Mycol. 15 : 312. 1917.

Hysterothecia dull black, chiefly hypophyllous, in stramineous spots or scattered over the entire leaf, broadly elliptical with rounded ends, well arched, 400–950 μ long, 270–400 μ wide, up to 165 μ deep, subcuticular. Labia prominent and extroverted in age, heavily carbonized, 25–35 μ wide, lined inwardly by a bright orange mass of clavately expanded, nonseptate, gelatinously agglutinated and persistent periphyses up to 35 μ long and 1.5–2 μ wide. Basal layer a brown, translucent plate one to several cells thick, the bottom layer aliform and radiately disposed; this overlaid to a depth of 5–10 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover an aliform plate extending 10–15 μ beyond the basal layer at the margins, underlaid by brown, translucent pseudocollenchyma to a depth of 12–20 μ. Paraphyses hyaline, filamentous, straight or flexuous, clavately expanded

at the tips and gelatinously agglutinated to form a compact orange epithecium up to 10 μ thick, 80–90 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered from about the middle to a short stipe, 65–80 μ long, 8–10 μ wide, 8-spored. Ascospores filiform, hyaline, nonseptate, of uniform diameter, straight or slightly twisted with the ascus, fasciculate and arranged in pairs, 50–60 μ long, 1.5–2 μ wide, incased in an inconspicuous, hyaline, gelatinous matrix. Mycelium of two kinds, one subcuticular, coarse, brown, 3–3.5 μ wide, distantly septate, and forming short aliform branches; the other very fine, hyaline, internal, 1–1.5 μ wide, aggregating into a close weft about the base of the hysterothecium.

Imperfect stage: According to von Höhnel (1918) *Sphaeria leptidea* Fries (K. vet Akad. Handl. 38 : 269. 1817 and Systema Mycologicum, vol. 2, p. 522. 1823) is not the perfect stage of this species. According to W. B. Grove (1922), *Leptothyrium melaleucum* Grove (Journ. Bot. 60 : 81. 1922) is associated with this species as an imperfect form in Perthshire, England. Grove reports, however, that *Lophodermium cladophilum* was on the stem parts of the same twigs and expresses the opinion that *L. melaleuca* is probably only a leaf form. This leaves the association of the Imperfect form uncertain.

Type locality: Not given by Fries.

Type specimen: Fries, Scleromyceti Sueciae exs. No. 29.

Host: Vaccinium sp. : New Jersey (Ellis & Everhart, 1892); *V. ovatum:* Oregon (Zeller, spec.); *V. Vitis-idaea:* England (Grove, 1922), France (Roumeguère, exs.); Germany (Krieger, exs., Fuckel, exs.); Italy (Traverso, 1903), Sweden (Fries, 1823), Switzerland (Jaap, 1907).

Exsiccati: Fuckel, Fungi rhen. No. 736; Krieger, Schadl. Pilze, without number, Sept. 1900; Mougeot and Nestler, Stirp. Crypt. No. 654; Roumeguère, Fungi. sel. Gall. exs. Nos. 269 and 454.

Specimen: S. M. Zeller, Waldport, Ore., October, 1929. No. 7568.

Illustrations: Fries, Observ. mycol. praecip. ad illustr. floram Suec., pt. 1, pl. 2, fig. 1. 1815; Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : pl. 1, fig. 5. 1929.

Notes: The *Phacidium Vaccinii* in Roumeguère's Fungi sel. Gall. exs. is typical *Lophodermina melaleuca.*

The species β *Hysterium pulchellum* of Fries, distinguished by its greenish yellow labia, is only old material in which the periphyses have become very dry and condensed. The colored mass of periphyses has also given rise to the variety *aureo-marginatum* Starbäck.

15. *Lophodermina nitens* (Darker) n. comb.

Hysterium pinastri Schrader, Schrader. Journ. Bot. 2 : 69. 1799, in part.
Hysterium limitatum Wiebel, Primitiae Florae Werth., p. 329, 1799, in part.
Aporia obscura Duby, Mém. Soc. Phys. et Hist. Nat Genève 16 : 63. 1861, in part.
Depazea linearis Rostrup, Tidsskr. Skovbr. 6 : 260. 1883, in part.
Hysterium pinastri β minor Westendorp, Herbier Crypt. Belge No. 68, (1841?).

Hysterothecia shining black, on the outer faces of needles and occurring singly, in pairs, or in pairs with one or two smaller hysterothecia in colonies, each colony cut off from adjacent ones above or below by very distinct, black, stromatic lines along which the leaves readily break, these lines double and composed of heavily carbonized and much compacted hyphal cells the terminations of which are aliform, elliptical, 650–1100 μ long, 350–525 μ wide, 150–300 μ high, subcuticular. Labia heavily carbonized, 40–70 μ wide, becoming widely separated and exposing nearly the entire hymenium, lined inwardly by a white mass of gelatinizing and soon evanescent, hyaline, clavately expanded periphyses 7–20 μ long and 1–1.5 μ wide. Basal layer a brown, translucent plate one to two cells thick, composed of radiately disposed, meandering, aliform plectenchyma; this overlaid to a depth of 20–30 μ by a closely interwoven, hyaline plectenchyma of very fine hyphae, from which the hymenium arises. Cover carbonized in the region of the labia, elsewhere more or less translucent, composed of an outer plate of radiately disposed aliform mycelium, which extends to a distance of 35–50 μ beyond the margin of the base, and an inner layer, several cells thick, of pseudocollenchyma. Paraphyses hyaline, filamentous, simple, nonseptate, clavately expanded at the tips, 65–100 μ long, 1.5–2 μ wide, shorter than the asci and forming no epithecium. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered from above the middle to a broad stipe, 65–130 μ long, chiefly 11–13 but rarely up to 16 μ wide, 8-spored. Ascospores hyaline, nonseptate, filiform, fasciculate and arranged in pairs, straight or intricately coiled within the ascus, 60–120 μ long, 2–3.5 μ wide, incased in a conspicuous, hyaline, gelatinous matrix 2–3 μ thick.

Imperfect stage: Not named. Darker (1932) reports an Imperfect form with numerous, black, wrinkled or smooth, subcircular pycnidia 50 × 80 μ to 350–400 μ, subcuticular and applanate in section, 30–40 μ deep, with conidiophores 5–9 μ long and 2–4 μ thick seated upon a basal plectenchyma 7–12 μ thick, and cylindrical, bacillar conidiospores 6.5–10 μ long by 0.8–1.5 μ wide.

Type locality: Timagami, Ontario, Canada.

Type specimen: J. H. Faull, No. 4882, May, 1924, on *Pinus Strobus.*

Hosts: *Pinus* sp. (2-needle) : Italy (Anzi, exs.); *P. albicaulis:* California, Idaho, Oregon (Darker, 1932), Germany (Jaap, 1905); *P.*

Cembra: (Rehm, 1887), Austria (Jaap, 1908), France (Roumeguère, exs.); *P. montana:* Austria (Jaap, 1908), Germany (Jaap, 1905); *P. Lambertiana:* California (Boyce, spec.), Oregon (Darker, 1932); *P. monticola:* California, Idaho (Weir, spec.), Oregon, Washington (Darker, 1932); *P. radiata:* California (Wagner, spec.; Boyce, spec.); *P. halpensis:* Austria (Jaap, 1916), France (Roumeguère, exs.); *P. Strobus:* Massachusetts, Michigan, New Hampshire, Pennsylvania (Overholts, spec.), Washington (Boyce, spec.), Nova Scotia, Ontario (Darker, 1932), Saxony (Krieger, exs.), Germany (Rehm, 1887; Kunze, exs.); *P. rigida:* New Jersey (Ellis & Everhart, exs.); *P. ponderosa:* Pennsylvania (Overholts, spec.); *P. virginiana:* Pennsylvania (Orton and Hass, spec.).

Exsiccati: Anzi, Erb. Critt. Ital. II, No. 541; Bartholomew, Fungi Columb. No. 4426; Ellis & Everhart, Fungi Columb. No. 1029; Kunze, Fungi sel. exs. No. 371; Krieger, Fungi saxonici No. 2373; Krypt. exsic. ed. u Museo Palat. Vindob. No. 1611; Rabenhorst, Fungi europ. No. 461; Roumeguère, Fungi sel. Gall. exs. No. 456; Seymour & Earle, Economic fungi, No. 200; de Thuemen, Fungi austriaci No. 871; Reliquiae Farlowiana No. 50.

Specimens: W. W. Wagner, Monterey, Cal., Mar. 17, 1930; J. S. Boyce, San Francisco, Cal., Jan. 27, 1920; Hyampton, Cal., June 12, 1914; Silverton, Wash., May 22, 1916; Overholts, Greenwood Furnace, Pa., Oct. 18, 1919; L. O. Overholts, Millheim, Pa., Apr. 19, 1925; Orton and Hass, Pine Grove Mills, Pa., May, 1914; L. O. Overholts, Charter Oak, Pa., June 14, 1920; Weir, Priest River, Idaho, Aug. 3, 1915.

Illustrations: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 20, figs. 10–15; pl. 27, fig. 2. 1932.

16. *Lophodermina orbicularis* (Ehrenberg) n. comb.

Hysterium orbiculare Ehrenberg, Fungos a viro clariss. Adalberto de Chamisso sub auspic. Romanzoff. in itinere circa terr. glob. coll. enum. novosque descrip. et pinxit, No. 30, 1820.

Lophodermium orbiculare Saccardo, Sylloge Fungorum 2 : 799. 1883.

Lophodermium orbiculare Ellis and Everhart, North American Pyrenomycetes, p. 717. 1892.

Hysterium gracile Ehrenberg, Fungos a viro clariss. Adalberto de Chamisso sub auspic. Romanzoff. in itinere circa terr. glob. coll. enum. novosque descrip. et pinxit, No. 31, 1820.

Lophodermium gracile Saccardo, Sylloge Fungorum 2 : 799. 1883.

Hysterothecia dark brown to black, shining, hypophyllous, in circular, light tan to cinereous, unlimited spots 2–4 mm. in diameter and these when situated near each other imbedded in wider dark brown dead areas, broadly elliptical, not greatly arched, with rounded ends, 375–525 μ long, 315–450 μ wide, subcuticular. Labia heavily carbonized, tending to become extroverted, nearly as long as the hysterothecium, 30–50 μ wide,

lined inwardly by a golden or orange mass of gelatinous, clavately expanded, persistent periphyses up to 25 μ long, 2.5–3 μ wide. Basal layer a brown, translucent plate of radiately disposed aliform hyphae; this overlaid to a depth of 5–7 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover rather flat, carbonized in the region of the labia, elsewhere more or less translucent, consisting of an outer plate of radiately disposed aliform cells underlaid to variable thicknesses by pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded at the tips but bent or crushed and gelatinously agglutinated into a dense, tough, orange-yellow epithecium about 20 μ thick, 80–100 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically subacute or rounded at the tips, tapered from somewhat above the middle to a broad stipe, 55–80 μ long, 9–12 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, twisted within the ascus but not coiled, 35–55 μ long, 2–2.5 μ wide, incased in an inconspicuous gelatinous matrix.

Imperfect form: Unknown.

Type locality: Unalaska.

Type specimen: Not specified.

Hosts: *Andromeda axillaris:* North Carolina (von Schweinitz, 1834); *A. lycopodioides:* Unalaska (Ehrenberg, 1820); *Chamaedaphne calyculata:* New Hampshire (Farlow, exs.), Ontario (Ellis and Everhart, 1892; Rehm, 1911; Dearness, spec.; Jackson, spec.).

Exsiccati: Ellis & Everhart, North Amer. Fungi. No. 2376; Ellis & Everhart, Fungi Columb. No. 127: Reliquiae Farlowianae No. 49; Rehm, Ascomyceten, No. 1926.

Specimens: John Dearness, London, Ont., Aug. 30, 1890; H. S. Jackson, Bear Island, Lake Temagami, Ont., Aug. 21, 1930.

17. *Lophodermina Paconiae* (Rehm) n. comb.

Lophodermium Paconiae Rehm, in litt., according to Vestergren, Botan. Notis. 1897, p. 259.

Hysterothecia dull to shining black, abundant, usually crowded and often confluent end to end or laterally in extensive, stramineous, unlimited areas on stems, subrotund to narrowly elliptical, 300–350 μ wide, 400–700 μ long, subcuticular. Labia prominent, heavily carbonized, 25–30 μ thick, 20–40 μ wide, nearly as long as the hysterothecium, lined inwardly by a white mass of gelatinous, clavately expanded, much compacted, hyaline periphyses 5–12 μ long by 1 μ wide. Basal layer a brown, translucent plate of loosely compacted, radially disposed aliform mycelium thickened, especially toward the center, by the apposition, above, of 2–5 layers of

brown, pseudoparenchymatous cells, this overlaid to a depth of 5–15 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized in the region of the labia, elsewhere more or less translucent, composed of an outer plate of brown, heavily chytinized, radially disposed aliform mycelium which extends outward 20–30 μ beyond the margin of the base and is thickened by the apposition, beneath, of 1–3 layers of brown, pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, nonseptate, simple, not clavately expanded but bent or crushed by pressure and gelatinously coalesced into a thin, white epithecium, 40–80 μ long, 1–1.5 μ wide. Asci cylindrical to subclavate, asymmetrically and bluntly rounded above, tapered from above the middle to a fine stipe up to 10 μ long, 65–80 μ long, 6–8 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 55–65 μ long, 1–1.5 μ wide, incased in an inconspicuous gelatinous matrix about 1 μ thick.

Imperfect stage: Unknown.

Type locality: Gotlandia, according to Vestergren (1897).

Type specimen: Not designated.

Hosts: *Paeonia* sp.: (Vestergren, 1897); *P. sinensis:* Germany, (Sydow, exs.).

Exsiccati: Sydow, Mycoth. Germ. No. 2534.

18. *Lophodermina prunicola* n. sp.

Hysterothecia small, shining black, scattered in light brown, extensive areas on the upper faces of leaves and on the petiole and the mid-vein beneath, broadly elliptical with somewhat pointed ends, 450–685 μ long, 270–435 μ wide, well arched above; subcuticular. Labia narrow and heavily carbonized, 25–35 μ wide, 20–25 μ thick, lined along the inner edges with a mass of white, clavate, gelatinously compacted and soon evanescent periphyses 2–2.5 μ wide and 10–15 μ long. Basal layer a plate one cell thick of radiately disposed, brown, translucent, aliform mycelium, this overlaid to a depth of 8–12 μ by a closely interwoven, hyaline layer of fine plectenchyma. Cover well arched, not heavily carbonized, translucent except in the lip region, of aliform construction throughout the top and radiately aliform at the margins, with a heavy deposit of pseudocollenchymatic cells toward the center, up to 20 μ thick. Paraphyses hyaline, filamentous, straight or flexuous, bent or crushed at the tips in the center of the hymenium, uncinate toward the margins, not swollen or gelatinously agglutinated, hardly exceeding the asci, 50–70 × 1–1.5 μ. Asci cylindric to subclavate, asymmetrically subacute at the tips, tapered from near the top to a short but fine stipe, 45–70 μ long, 6–8 μ wide,

8-spored. Ascospores hyaline, filamentous, straight or slightly twisted within the ascus, fasciculate and arranged in pairs, blunt at both ends and of uniform diameter throughout their length, 35–60 × 0.75–1 μ, gelatinous matrix hyaline, inconspicuous.

Imperfect stage: Unknown.

Type locality: Ouray, Colorado.

Type specimen: Clements' Cryptogamae Formationum Coloradensium No. 465.

Host: *Prunus demissa:* Colorado (Clements, exs.).

Notes: This material was identified and distributed by Clements under the name *Lophodermium hysteroides* (Pers.) Sacc., which it resembles in some respects. It is, however, the first record of a fungus of this type on Prunus and differs from *Lophodermellina hysteroides,* which is known to occur on other members of the Rosaceae, in being subcuticular as well as in the size of its hysterothecia, asci, and spores.

19. *Lophodermina punctiformis* (Fries) n. comb.

Hysterium petiolare de Albertini and von Schweinitz, Conspect. fung. in Lusat. superior. agro Niski, cresc., p. 59. 1805.

Hysterium punctiforme Fries, Observ. mycol. pracip. ad illustr. floram Suec., pt. 2, p. 356. 1818; K. Vet. Akad. Handl. 40 : 103. 1819; Systema Mycologicum, vol. 2, p. 593. 1823.

Lophodermium petiolare Chevallier, Flore gén. des env. de Paris, vol. 1, p. 436. 1826.

Lophodermium petiolicolum Fuckel, Jahrb. d. Nassauischen Ver. f. Naturk. 23/24 : 255. 1869.

Lophodermium punctiforme Fuckel, Jahrb. d. Nassauischen Ver. f. Naturk. 23/24 : 255. 1869.

Hysterium punctiforme Oudeman, Nederl. Kruidk. Arch., ser. 2. 1 : 50. 1872.

Lophodermium echinophilum Spegazzini, according to Saccardo, Michelia 1 : 56. 1877.

Hysterothecia shining black, scattered in stramineous areas on petioles, large nerves and leaf blades, on small nerves oriented parallel with the nerve axis, on petioles and blades without orientation, elliptical to nearly linear, acutely rounded at the ends, amphigenous, straight or unequilateral and lunate, 650–1500 μ long, 340–400 μ wide, subcuticular. Basal layer a light brown, translucent plate one cell thick, consisting of radiately disposed aliform hyphae emanating from an elongated, narrow, central pseudoparenchyma; this overlaid to a depth of 10–15 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Labia well defined, heavily carbonized, 50–65 μ wide, reaching to within 175 μ of each end of the hysterothecium, lined inwardly by a densely agglutinated, white mass of evanescent periphyses up to 20 μ long, 2.5–3 μ wide. Cover heavily carbonized at the margins and in the labia, in the intervening area more or less translucent, con-

sisting of an outer plate of radiately disposed, aliform, meandering prosenchyma thickened by the apposition, beneath, of 2 to 4 rows of pseudocollenchymatous cells. Paraphyses hyaline, filamentous, straight or flexuous, not clavately expanded but crushed and bent at the tips by pressure, 60–90 μ long, 1–1.5 μ wide, gelatinously agglutinated above the asci into a white epithecium 5–10 μ thick. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered below to a long thin stipe, 45–77 μ long, 5.5–6.5 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or slightly twisted with the ascus, 33–50 μ long, 1–1.5 μ wide, incased in a hyaline, gelatinous matrix 1.5–2 μ thick.

Imperfect stage: Leptostroma petiolicolum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 88. 1929.–Pycnidia intermixed with the hysterothecia, shining black, subcuticular, round, 100–300 μ in diameter, up to 75 μ high, wall consisting of meandering, aliform prosenchyma, brown above, nearly hyaline below. Conidiophores hyaline, tapering from 2 μ wide at the base to 1 μ at the tips, septate, unbranched. Conidia bacilliform, hyaline, nonseptate, 4–5 μ long, 1 μ wide.

Type locality: Not given by Fries.

Type specimen: Not given by Fries.

Hosts: *Castanea sativa:* (Rehm, 1887; Saccardo, 1877), Austria (Jaap, 1916), Czechoslovakia (Hilitzer, 1929); *Quercus* sp.: Germany (Rehm, 1887), France (de Thuemen, exs.); Russia (Potebnia, 1910); *Q. lanuginosa:* Austria (Jaap, 1916); *Q. Robor:* Saxony (Rabenhorst, exs.); *Q. rubra:* France (Roumeguère, exs.), Germany (Sydow, exs.), Czechoslovakia (Hilitzer, 1929); *Q. sessiliflora:* Czechoslovakia (Hilitzer, 1929); *Fraxinus* (Rehm, 1887; Roumeguère, exs.); *Acer* (Fries, 1823); *A. saccharinum:* New York (Ellis & Everhart, 1892).

Exsiccati: Rabenhorst, Fungi europ. Nos. 462, 2642; Roumeguère, Fungi sel. exs. No. 7044; Roumeguère, Fungi Gallici exs. Nos. 1659, 1660; Sydow, Mycoth. Germ. No. 1345; de Thuemen, Mycoth. univ. No. 1757.

Note: *Hysterium petiolare* as illustrated in Desmazière's exsiccati Ser. 2, Nos. 181 and 563 is, according to Duby (1861, p. 64), Peziza. I have not seen these specimens.

20. *Lophodermina Rhododendri* (von Schweinitz) n. comb.

Plate III, Fig. 12.

Hysterium Rhodendri von Schweinitz, Trans. Am. Philos. Soc., n.s. 4 : No. 2116. 1834.

Hysterium sphaerioides var. *Rhododendri* Rabenhorst, Fungi europaei No. 355. 1861.

?*Lophodermium Rhododendri* de Cesati, Rendic. Acc. Sci. fisich. e matem. di Napoli 9 : No. 537. 1870.
Coccomyces Rhododendri Saccardo, Sylloge Fungorum 8 : 748. 1889.
Lophodermium Rhododendri Ellis and Everhart, North American Pyrenomycetes, p. 717. 1892.

Hysterothecia dull black, amphigenous, scattered in light stramineous, irregular spots 2–10 mm. or more in diameter and conspicuously limited by a black, stromatic line, oval, ends tapered and rounded, 750–1350 μ long, 340–675 μ wide, subcuticular. Labia conspicuous, well arched, carbonized, 20–50 μ wide, up to 35 μ thick, lined inwardly by a white mass of gelatinous, soon evanescent hyaline, clavately expanded, septate periphyses 10–15 μ long and 5–7 μ wide. Basal layer a brown, translucent plate one or two cells thick consisting of radiately disposed, definitely aliform prosenchyma; this overlaid to a depth of 10–15 μ by a closely interwoven and compacted hyaline plectenchyma of very fine hyphae from which the hymenium arises. Cover well arched, carbonized in the region of the labia, somewhat carbonized near the margins, but in the intervening area more or less translucent, the outer, aliform plate appearing distinctly netted because of the blackening of the epidermal cell walls. Paraphyses hyaline, filamentous, guttulate, straight and slightly clavately enlarged at the tips, 100–125 μ long, not exceeding the asci and not uniting into an epithecium. Asci cylindrical to subclavate, asymmetrically rounded to subacute at the tips, tapered toward the base to a short, moderately fine stipe, 80–125 μ long, 9–14 μ wide, 8-spored. Ascospores filiform, hyaline, of uniform diameter, fasciculate and arranged in pairs, 66–90 $\times$ 2–2.5 μ wide, inclosed in a conspicuous hyaline, gelatinous matrix up to 2 μ thick.

Imperfect stage: Unknown.

Type locality: Bethlehem, Pennsylvania.

Type specimen: von Schweinitz, Bethlehem, Pa., on Rhododendron.

Hosts: *Rhododendron:* Pennsylvania (von Schweinitz, 1834; Orton, spec.; Overholts, spec.; Overholts and Kirby, spec.); Oregon (Zeller, spec.); *R. californicum:* Oregon (Zeller, spec., 1927), New York (Ellis & Everhart, 1892); *R. catawbiense:* North Carolina (Ellis & Everhart, 1892) Tennessee (Charles, spec.); *R. ferrugineum:* Central Alps (Rehm, 1887); *R. maximum:* Pennsylvania (Overholts, spec.), West Virginia (Ellis, exs.).

Specimens: C. R. Orton, Galbraith's Gap, Center Co., Pa., Apr. 30, 1918; L. O. Overholts, Cooke Forest, Cooksburg, Pa., Aug. 16, 1927 and Aug. 17, 1927; Bear Meadows, Pa., Aug. 11, 1921 and May 13, 1925; Ingleby, Center Co., Pa., July 13, 1929; Stone Creek, Hunt Co., Pa., Aug. 6, 1927; Coxe's Valley, Mifflin Co., Pa., June 9, 1921; Stone Valley, Huntingdon Co., Pa., Jan. 2, 1921; L. O. Overholts and R. S.

Kirby, Stone Valley, Pa., Aug. 10, 1924; Vera K. Charles, Roan Mountain, Tenn., 1909; S. M. Zeller, Alsea Mt., Ore., June 17, 1922, No. 2340, and June, 1922, No. 2359.

Exsiccati: Ellis, North Amer. fungi No. 1287; Ellis & Everhart, Fungi Columb. No. 738; Rabenhorst, Fungi europ. Nos. 355, 458; Rehm, Ascomyceten No. 126.

21. *Lophodermina septata* n. sp.

Hysterothecia shining black, amphigenous, solitary in light stramineous areas sharply delimited by black, stromatic lines from uninfected distal and proximal parts, broadly oval with rounded to truncate ends, subcuticular, 800–1200 μ long, 400–625 μ wide. Labia indistinct, not at all or only very slightly carbonized, neither arched nor extrovert in age, 8–20 μ wide, lined inwardly by a white mass of hyaline, clavately enlarged, gelatinously agglutinated, persistent periphyses 10–25 μ long and 2.5–3 μ wide. Cover somewhat arched, thin and not carbonized, consisting of heavily chytinized, translucent, light brown, meandering aliform mycelium, somewhat thickened in the region of the labia by the deposition of one to several layers of translucent pseudocollenchyma. Basal layer a plate one cell thick of brown, translucent, radiately disposed, aliform mycelium, sometimes thickened near the center by deposition on the upper side of one or two layers of pseudoparenchyma; this overlaid to a depth of 10–25 μ by a very closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Paraphyses hyaline, filamentous, nonseptate, straight or flexuous, not clavately expanded above, shorter than the asci and not forming an epithecium. Asci long cylindric to clavate-cylindric, asymmetrically long-acute at the tips, tapered from near the apex to a fine, long stipe, 115–165 μ long, 10–14 μ wide, 8-spored. Ascospores hyaline, fasciculate and arranged in pairs, clavate-filiform, 85–120 μ long, 1.5–2 μ wide at the tips, tapered to less than 1 μ wide at the base, straight or coiled within the ascus, incased in a conspicuous, hyaline, gelatinous matrix 2–3 μ thick, the spores septate at intervals of 8–15 μ.

Type locality: Knappa, Clatsop County, Oregon.

Type specimen: E. J. Perkins, May 3, 1919. No. K-1000.

Host: *Picea sitchensis:* type locality only.

22. *Lophodermina Thuyae* (Davis) n. comb.

Plate II, Fig. 7.

Lophodermium Thuyae Davis, Trans. Wisc. Acad. Sci., Arts and Lett. 20 : 424. 1922.

Hysterothecia shining black, amphigenous on dead needles, elliptical, with abruptly rounded ends, 525–950 μ long, 225–500 μ wide, subcuticular.

Labia prominent and well arched and spreading, heavily carbonized in the central parts, less so or not at all toward the ends, up to 80 μ wide and 45 μ thick in the middle, tapering to lesser widths toward the ends, lined inwardly with a white mass of clavately enlarged, gelatinously agglutinated and soon deliquescent, hyaline periphyses 7–15 μ long and 1–1.5 μ wide. Basal layer a brown, translucent plate one cell thick, consisting of radiately disposed, digitate, aliform prosenchyma; this overlaid to a depth of 20–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae with an upper columnar layer 10–15 μ thick, from which the hymenium arises. Cover well arched, translucent except in the region of the labia, consisting of an outer plate of digitately branched aliform hyphae and a considerable deposit, on the lower side, of pseudocollenchymatous cells. Paraphyses hyaline, straight or flexuous, simple, clavately enlarged at the tips, often also much bent or crushed by pressure, coalescing in a gelatinous, white epithecium 5–10 μ thick, 100–130 μ long, about 2 μ wide. Asci quite regularly cylindrical, asymmetrically acute at the tips, abruptly narrowed at the base to a very short stipe and broad foot, 95–125 μ long, 8–12 μ wide, regularly and without exception 4-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, rounded at the tips and tapered to a subacute base, 80–115 μ long, 1.5–2 μ wide, incased in a conspicuous, hyaline, gelatinous matrix 2–2.5 μ wide.

Imperfect stage: Unknown.

Type locality: Saxon, Wisconsin.

Type specimen: Davis, Fungi Wisconsinenses exsiccati No. 114.

Host: *Thuja occidentalis:* New Hampshire (Darker, 1932), Wisconsin (Davis, 1922 and exs.), Ontario (Darker, 1932).

Exsiccati: Davis, Fungi. Wisc. exs. No. 114.

Illustrations: Davis, Trans. Wisc. Acad. Sci., Arts and Lett. 20 : 425, fig. 2, 1922: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 21, figs. 6–9. 1932.

23. *Lophodermina uncinata* (Darker) n. comb.

Lophodermium uncinatum Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : 76. 1932.

Hysterothecia shining brownish black, amphigenous but chiefly epiphyllous, scattered, usually discrete but occasionally becoming confluent end-to-end, narrowly elliptical to rectangular and bluntly rounded to truncate at the ends, 500–2250 μ long, 200–500 μ wide, 190–300 μ deep, subcuticular. Labia heavily carbonized but indistinct and merging into the cover, lined inwardly by a white mass of clavately expanded, gelatinizing and soon evanescent periphyses 8–20 μ long and 1–1.5 μ wide.

Basal layer a brown, translucent plate one or two cells thick, composed of radiately disposed, aliform prosenchyma; this overlaid to a depth of 15–30 μ by a closely interwoven, hyaline plectenchyma of fine hyphae from which the hymenium arises. Cover carbonized at the margins and in the regions of the labia, the intervening area more or less translucent, composed of an outer aliform plate, which extends to a distance of 15–70 μ beyond the margin of the basal layer, thickened by the apposition, beneath, of pseudocollenchymatous cells to a depth of 40–60 μ. Paraphyses hyaline, filamentous, simple, nonseptate, not clavately expanded at the tips but often strongly uncinate, exceeding the asci and gelatinously agglutinated into a white epithecium up to 25 μ thick. Asci cylindrical to subclavate, asymmetrically subacute at the tips, tapered from about the middle to a fine stipe, 100–135 μ long, 12–15 μ wide, 8-spored. Ascospores hyaline, filiform, nonseptate, fasciculate and arranged in pairs, straight or somewhat twisted with the ascus, 50–75 μ long, 1.5–2 μ wide, incased in a conspicuous, hyaline, gelatinous matrix 3–4 μ thick.

Imperfect form: Not named: Darker (1932) reports an associated imperfect form with pycnidia which form small, rounded or elliptical blisters, yellowish to reddish orange at first and black at maturity, subcuticular in position, 160–325 μ long, 110–210 μ wide, with hyaline, bacillar, conidia 4–6 μ long and 0.8–1 μ wide. The hyphae making up these pycnidia have the same aliform characters as is evident in the hysterothecia.

Type locality: Government Camp, Clackamas County, Oregon.

Type Specimen: G. D. Darker, July, 1929, on *Abies amabilis*, No. 275 in the Arnold Arboretum Pathological Herbarium.

Host: *Abies amabilis: Oregon* (Darker, 1932), Washington (Grant, spec.).

Specimens examined: Darker's type specimen; Herb. J. M. Grant, "*Lophodermium Abietis*," Marysville, Wash., March, 1927.

Illustrations: Darker, Contrib. Arnold Arboretum of Harvard Univ. 1 : pl. 20, fig. 16. 1932.

24. *Lophodermina versicolor* (Wahlenberg *ex.* Fries) n. comb.

Hysterium versicolor Wahlenberg, Flora Lapponica, p. 522, 1812.
Hysterium versicolor Fries, Systema Mycologicum vol. 2, p. 592, 1823.
Lophodermium versicolor Rehm, in Rabenhorst's Kryptogamen Flora, vol. 3, p. 48. 1887.

Hysterothecia small, shining black, amphigenous in light, yellowish spots of very variable size on the blades of dead leaves, subcuticular, 350–600 μ long, 150–375 μ wide, broadly elliptical with bluntly rounded ends. Labia only lightly carbonized, extroverted, as long or nearly as

long as the hysterothecium, up to 85 μ wide in the central portion and tapered to as little as 10 μ wide at the ends, lined inwardly with a persistent yellow mass of nongelatinized, clavately expanded, periphyses 15–25 μ long and 1.5–2 μ wide. Basal layer a plate one cell thick of brown, translucent, radiately arranged aliform hyphae, this overlaid to a depth of 12–20 μ by a yellow, intricately interwoven, fine plectenchyma. Cover a thin, non-carbonized plate of meandering aliform hyphae overreaching the basal layer at the margins and there forming a rim or skirt of aliform cells, the central portions underlaid by a thin development of pseudocollenchymatous cells. Paraphyses straight or variously curved, much bent and crushed above by pressure, and intertwining above the asci to form a thin yellow epithecium, 60–85 μ long, 1–1.5 μ thick, without gelatinous coating. Asci cylindrical to subclavate, asymmetrically and conically subacute at the tips or bluntly and asymmetrically rounded, tapered from above the middle, 35–75 μ long, 5–8 μ wide, 8-spored. Ascospores hyaline to yellow-tinted, straight in the longest asci, in the others often intricately coiled, fasciculate and arranged in pairs, 25–45 μ long, 0.75–1 μ wide, without evident gelatinous matrix.

Imperfect stage: Unknown.

Type locality: Not specified.

Type specimen: Not specified.

Hosts: *Salix hastata* (Fries, 1823); *S. arbuscula* (Fries, 1823); *S. herbacea* (Lind, 1905); *S. glauca* (Lind, 1905); *S. retusa:* Germany (Rehm, 1896); *S. pentandra:* Pennsylvania (Overholts, spec.); *S. pseudolapponum:* Colorado (*Clements, exs.*).

Exsiccati: Clements, Crypt. Format. Colo. No. 49.

Specimen: L. O. Overholts, Greenwood Furnace, Pa., May 15, 1925.

Illustrations: Wahlenberg, Flora Lapp. pl. 30, fig. 5. 1812.

Notes: Rehm (1896) gives no details of the asci and spores in his description of this species and lists it among the doubtful. According to Lind (1905), it should be regarded as the same as *L. hysterioides,* as should also the report by Rostrup (Bot. Tidsskr. 25 : 310. 1903) of *L. maculare* on *Salix glauca.* The writer has not seen any material from Europe; but the material in Clements' Cryptogamae Formationum Coloradensium No. 49 has furnished good asci, spores and paraphyses. Wahlenberg's comment that this is a beautiful species is justified by the yellow mass of persistent periphyses, which fringe the extroverted labia, and the bright yellow epithecium.

EXCLUDED SPECIES

Among the 131 recorded species names directly assigned at one time or another to Lophodermium it is natural that, besides those that are syn-

onyms, certain names will have been used to designate fungi not properly capable of being included within Lophodermium or the three derivatives of it discussed in this paper. The following list indicates these incompatible species and gives the treatments that have been accorded them.

1. *Lophodermium Abietis-concoloris* Mayr

Die Waldungen von Nordamerika, p. 336. 1890.

According to Dearness (1924), the material upon which this name was based was too immature to describe. The species is figured by von Tubeuf (1901, p. 16), and Dearness (*l. c.*) has concluded that it is the same as material studied by him, which had been taken by J. S. Boyce (No. 732) in Baker County, Oregon, and by E. Bethel in Colorado on *Abies concolor*. Dearness has renamed the species *Hypodermella Abietis-concoloris* (Mycologia 16 : 150. 1924).

2. *Lophodermium amplum* Davis

Trans. Wisconsin Acad. Sci., Arts and Lett. 19 : 695. 1919.

This species was described on *Pinus Banksiana* from Wisconsin and Dearness (1924) reports it also on *Pinus contorta* from Oregon. Dearness (*l. c.*) finds it closely similar to *Hypodermella sulcigena* on *Pinus sylvestris* but maintains it as a separate species under the name *Hypodermella ampla* Dearness (Mycologia 16 : 152. 1924).

3. *Lophodermium brachysporum* Rostrup

Tidsskr. Skovbr. 6 : 281. 1883.

Von Tubeuf (1895, p. 247) transferred this species to Hypoderma; and Darker (1932, p. 25) considered it as synonymous with *Hypoderma Desmazierii* Duby.

4. *Lophodermium gilvum* Rostrup

Tidsskr. Skovbr. 6 : 283. 1883.

It has been shown by Darker (1932, p. 92) that this name is synonymous with *Naemacyclus niveus* (Pers. *ex* Fries) Saccardo.

5. *Lophodermium infectans* Mayr

Die Waldungen von Nordamerika, p. 336. 1890.

Boyce (1927) has shown that this is synonymous with *Hypoderma robustum* von Tubeuf.

6. *Lophodermium lineare* Ellis and Everhart

The North American Pyrenomycetes, p. 721. 1892.

This fungus is remarkable in that it is without paraphyses and has ascospores 5-8 μ wide at the ends but distinctly narrower in the middle. It has been made by von Höhnel (1917) the type species of his genus Bifusella and has as synonyms *Hypodermium effusum* von Schweinitz, *Rhytisma lineare* Peck, and *Hypoderma lineare* de Thuemen.

7. *Lophodermium lineatum* Smith and Ramsbottom

Trans. Brit. Mycol. Soc. 6 : 365. 1920.

The description of the species is based on material taken from *Pinus excelsa* at Wexford, Ireland. The asci range from 70 to 105 μ in length by 18–20 μ wide. The ascospores are 25–35 μ long by 2.5–3 μ wide. Darker (1932) is right in regarding this as a synonym of *Hypoderma Desmazierii* Duby.

8. *Lophodermium nervisequium* Chevallier

Flore général des environs de Paris, vol. 1, p. 435. 1826.

This is one of the species originally transferred from Hysterium by Chevallier when he established the genus Lophodermium. Its synonyms are *Hypoderma nervisequium* De Candole (1815), *Lophoderma nervisequium* Chevallier (1822), *Hysterium nervisequium* Fries (1823), *Hypodermium nervisequium* Link (1825), *Schizoderma nervisequium* Duby (1830), and *Daedalea nervicola* Hazslinsky (1887).

Lagerberg (1910, p. 148) transferred it to Hypodermella, because of its distinctly clavate spores; and Darker (1932) has found that it is not a homogeneous species and has separated from it a form with inconspicuous, colorless pycnidia to which he has given the name *Hypodermella lirelliformis* (Darker, *l. c.*, p. 45). It has also been transferred by von Höhnel (1916, p. 54) to his genus Hypodermina.

9. *Lophodermium Petersii* Saccardo

Sylloge Fungorum 2 : 795. 1883.

This is a North American fungus described by Berkeley and Curtis (1859) as *Hysterium Petersii "in Cupressi v. Juniperi* (Cedar) *foliis* (?). Alabama." It is not a Lophodermium but is properly identifiable as *Clithris Juniperi* (Karst.) Rehm.

10. *Lophodermium platyplacum* Saccardo

Sylloge Fungorum 2 : 792. 1883.

This fungus, on Clusia, was originally named *Hysterium platyplacum* by Berkeley and Curtis (1869, p. 792). I have not seen original material, and the transcription of the description by Saccardo (*l. c.*, 1883) is not sufficient for an accurate diagnosis. I have, however, examined a specimen, identified as this species, which was collected by Dr. Fred J. Seaver in the island of Trinidad. Seaver's material is not a Lophodermium. The hysterothecium lacks a definite ostiole and periphyses, and its base and cover are apparently continuous pseudocollenchyma. It is, however, identical with *Clithris Clusiae* Tehon (1918).

Assuming that the fungus described by Berkeley and Curtis from Cuba is identical with that described by Tehon from Porto Rico and that collected in Trinidad by Seaver, the proper name would be *Clithris platyplacum* (Berkeley and Curtis) n. comb.

This is in accord with the opinion of von Höhnel (1917, p. 311) who examined the type specimen (Fungi Cubensis Wrightiani No. 725) and described the fungus contained therein as an "überreife Phacidiaceae, deren Gattungs zugehörigkeit unsicher ist. Zwischen der Blattepidermis und den Palissadenzellen sind zwei Lagen von tafelformigen Parenchymzellen eingeschaltet, in deren ausserer Lage sich der Fruchtkörper entwickelt."

11. *Lophodermium Rubi* Chevallier

Flore général des environs de Paris, vol. 1, p. 436. 1826.

Persoon named this fungus *Hysterium virgultorum* in 1796 (p. 84); Chevallier (1822, p. 31) named it *Lophoderma Rubi*; and Fries called it *Hysterium Rubi* (1823, p. 587). But De Candole (1815, p. 165) placed it in his genus *Hypoderma* under the specific name *virgultorum*. Chevallier transferred it, with his other species, to Lophodermium in 1826. Since the revival of De Candole's genus Hypoderma by de Notaris (1847), this fungus has been quite properly known as *Hypoderma virgultorum* (Persoon) De Candole.

12. *Lophodermium javanicum* Penzig and Saccardo

Icones fungorum Javanicorum, p. 65. 1904.

It has been pointed out by von Höhnel (1917, p. 312) that in this species the intraepidermal ascoma is surrounded to a distance of 100 μ by epidermal cells filled with black, opaque material. This apparently is stromatic, and removes the species from Lophodermium. I have not

seen material of it; but its characters as published indicate a close relationship to Xyloma Pers., according to the analysis of von Höhnel (1917, p. 419).

13. *Lophodermium Sambuci* Rehm

Rabenhorst's Kryptogamen-Flora 3 : 48. 1887.

First named by Schumaker (1803, p. 152) *Hysterium Sambuci*, it was transferred to Lophodermium by Rehm (*l. c.*) with a query as to its possible relationship to the Lophiostomataceae. Rostrup (1885), however, had shown that Schumaker designated with his name the fungus to which Persoon applied the name *Opegrapha varia* in 1794. According to Lind (1905), the fungus on Sambucus is not a Lophodermium.

14. *Lophodermium Phacidium* de Notaris

Giorn. Bot. Ital. 2 : 42. 1847.

Rehm (1896, p. 1248) has made this a synonym of *Coccomyces coronatus* (Schum.) de Not.

15. *Lophodermium cladophilum* Rehm

Rabenhorst's Kryptogamen-Flora 3 : 42. 1887.

This species is redescribed and transferred to the genus Bifusella in the following section (p. 117).

16. *Lophodermium Lauri* Rehm

Rabenhorst's Kryptogamen-Flora 3 : 37. 1887.

Rehm's disposition of this fungus is called in question, since the ascospores are less than one-half the length of the ascus. Redescription is given in the following section (p. 120).

17. *Lophodermium Ameplodesmi* de Cesati, in literature

The Lophodermium on *Ampelodesmus tenax*, to which this name is applied in literature, is properly called *Lophodermium eximium* de Cesati (p. 48). *Hypoderma Ampelodesmi* de Cesati is another fungus on the same host and is characterized by having loculate hysterothecia and 2-celled ascospores (p. 122).

18. *Lophodermium scirpinum* (Persoon *ex* Fries) Chevallier

Hysterium scirpinum Persoon, in Mougeot and Nestler. Stirpes Cryptogamae Vogeso-Rhenanae quas in Rheni superioris inferiorisque, nec non Bogesorum praefecturis collegerunt. No. 475. 1815.
Hypoderma scirpinum DeCandolle, Flore française, 5 : 166. 1815.
Hysterium scirpinum Fries, K. Vet. Akad. Handl. 40 : 95. 1819.
Lophoderma scirpinum Chevallier, Journ. de Physique 94 : 31. 1822.
Hysterium scirpinum Fries, Systema mycologicum 2 : 590. 1823.
Lophodermium scirpinum Chevallier, Flore gén. d. env. d. Paris. 1 : 436. 1826.

I have had for examination material on *Scirpus lacustris,* the host indicated by Fries (1823, p. 590), distributed in Roumeguère's Fungi Sel. Gall. exs. No. 168. This material is definitely identifiable as a Hypoderma; and the proper designation for the species appears therefore to be *Hypoderma scirpinum* (Persoon) DeCandolle.

REPLACEMENT OF SPECIES

In the examination of specimens upon which the body of this paper is based, it was found that four fungi encountered were not classifiable in the categories given in the systematic and descriptive section. These are given proper placement below.

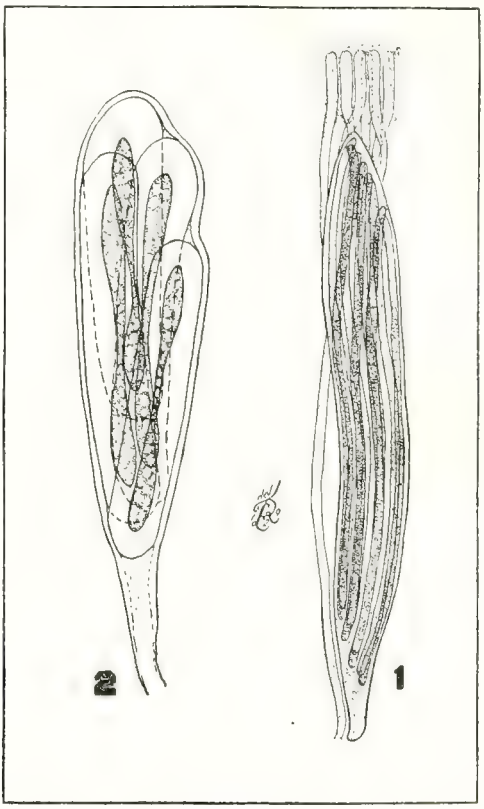
1. *Bifusella Vaccinii* (Carmichael) n. comb.

Text-Fig. 1.

Hysterium Vaccinii Carmichael, in J. E. Smith's English Flora, vol. 5, pt. 2, p. 295. 1836.
Hysterium cladophilum Leveille, in Mougeot and Nestler, Stirp. Crypt. No. 1243. 1850.
Sporomega cladophila Duby, Mem. Soc. Phys. et Hist. Nat. Geneve 16 : 60. 1861.
Lophodermium cladophilum Rehm, in Rabenhorst's Kryptogamen-Flora 3 : 42. 1887.
Lophodermium Vaccinii Schröter, Kryptogamenflora von Schlesien, vol. 2, p. 177. 1908.

Hysterothecia appearing golden brown, scattered or crowded in dead portions of stems, not in distinguishable spots, broadly ellipitical with somewhat truncated ends, 450-675 μ long, 325-375 μ wide, subepidermal, often oriented with the long axis at an angle to the axis of the stem, the host epidermis splitting lengthwise of the stem regardless of the orientation of the hysterothecium. Labia indefinite, somewhat thickened and carbonized in the middle, two-thirds to three-fourths the length of the hysterothecium. Basal layer a thin plate of loose pseudoparenchyma browned at the unions of cells but scarcely distinguishable from the thin,

hyaline plectenchyma from which the hymenium arises. Cover a compact, brown, more or less translucent plectenchyma underlaid to varying thicknesses by brown pseudoparenchyma. Paraphyses filamentous, hyaline, straight or flexuous, not clavately expanded but variously bent or crushed at the tips which are gelatinously fused into a thin, readily dissolved,



TEXT–Fig. 1.—Asci and spores of Dermascia and of Bifusella: (1) *Dermascia caricina*, ascus with spores and paraphyses (Roumeguère, Fungi sel. exs. No. 7142); (2) *Bifusella Vaccinii*, ascus showing the four bifusiform spores and the prominent gelatinous matrix of each spore (Reliquiae Farlowiana No. 46).

white epithecium, 90-115 μ long, about 1 μ wide. Asci clavate, truncately rounded above, tapered to a long, fine stipe, 85–100 μ long, 15–20 μ wide, 4-spored. Ascospores hyaline, nonseptate, bifusiform, 55–62 μ long, 4–5 μ wide, incased in a conspicuous, hyaline, cylindrical, gelatinous matrix 2.5–3 μ thick.

Imperfect stage: Unknown.

Type locality: Unknown.

Type specimen: ?Mougeot & Nestler, Stirp. Crypt. No. 1243.

Hosts: *Vaccinium Myrtillus:* England (Carmichael, *l. c.;* Cooke, 1871; Massee, 1895), Vosges Mountains (Jaap, 1911); *Vaccinium pennsylvanicum:* New Hampshire (Reliq. Farl.), New Jersey (Ellis and Everhart, 1892).

Exsiccati: Reliquiae Farlowiana No. 46. Rehm cites also Fuckel, Fungi rhen. No. 1967; Kunze, Fungi sel. No. 373; Rabenhorst, Herb. myc. II, No. 260; and de Thuemen, Fungi austr. No. 507.

Illustrations: Cooke, Handbook of British Fungi, p. 764, fig. 360. 1871.

Note: Bifusella, according to von Höhnel (1917, p. 418), is subcuticular and stromatic, neither of which characters the above fungus possesses. It is, however, the only genus distinguished by bifusiform spores; and it appears logical at present to include in it the above species.

2. EPIDERMELLA new genus

Genus of the Hypodermataceae with subrotund to linear ascomata developed beneath the cuticle and above the epidermis, opening by means of an elongated ostiole lined by gelatinizing, persistent or evanescent periphyses. The ascoma in the form of a hysterothecium with separately developed base and cover. Hymenium consisting of both asci and paraphyses. Asci clavate and long stalked. Ascospores elongated, non-septate, hyaline, one-third to one-half the length of the ascus, incased in a hyline, gelatinous matrix. Paraphyses filamentous, hyaline, gelatinously united above the asci into an epithecium.

Type species: *Epidermella communis* (Fries).

Epidermella communis (Fries) n. comb.

Hypoderma virgultorum De Candole, Flore Française, vol. 5, p. 165, 1815, in part.
Hysterium commune Fries, Systema Mycologicum, vol. 2, p. 589. 1823.
Hypoderma commune Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 53. 1861.

Hysterothecia dull black, scattered in light stramineous, oval spots 2 to several mm. long, elliptical, up to 1 mm. long by 650 μ wide, subcuticular. Labia distinct, thickened, tending to become heavily carbonized in the middle region, up to 85 μ wide, bordered inwardly by a bright orange mass of gelatinous, clavately expanded, periphyses 20-25 μ long by 6 μ wide at the tips. Basal layer a plate one cell thick of loose, brown, radiately disposed prosenchyma; this overlaid to a depth of 15-20 μ by a closely interwoven hyaline plectenchyma from which the hymenium arises. Cover a brown, translucent plate of heavily chytinized, aliform mycelium underlaid by several layers of brown pseudoparenchyma, thickest near the labia, very thin at the margins. Paraphyses hyaline, filamen-

tous, nonseptate, simple, not clavately expanded but crushed and bent by pressure at the tips and united above the asci in a gelatinous, orange epithecium about 10 μ thick, 80-125 μ long, about 1 μ wide. Asci clavate, broadly rounded above, tapered to a long, fine stipe, 65–120 μ long, 12–17 μ wide, 8-spored. Ascospores hyaline, cylindrical, nonseptate in the ascus, loosely fasciculate, 20-33 μ long, 3-4 μ wide, incased in a hyaline gelatinous matrix up to 2 μ thick.

Imperfect stage: Leptostroma omissum Hilitzer, Vědecké spisy vydáv. Českoslov. Akad. Zeměd. 3 : 105. 1929.

Type locality: Not given by Fries.

Type specimen: Not cited by Fries. The description is written from Roumeguère's Fungi Gallici exsiccati No. 3546, bearing the note: "sur les sarments dessechees du Houblon, aux environs d'Audenarde (Belgique). (Reliq. Westendorpii)." This is probably the type of Westendorp's f. *Lupuli.*

Notes: The basal plate of the hysterothecium appears to have been produced by the emanation of hyphae from a point located at about the center of the mature hysterothecium. Here, there are as many as 4 polygonal cells from which develop radiating branches whose outward growth takes place by the dichotomous branching of apical cells typical of aliform mycelium. The method by which the outer layer of the cover is produced was not observable; but this layer consists of a densely laid plate of aliform cells, the general orientation of which indicates a development progressing step by step with the basal layer.

The aliform structure of the hysterothecium, together with its subcuticular position and the separation of base and cover, indicates for this fungus a relationship with the Hemisphaeriales as clear cut as is the case with species of Lophodermium.

The material on Cassia, distributed in Ravenel's Fungi Americani exsiccati No. 323, is in our copy sterile but agrees with the Roumeguère exsiccatum in being subcuticular and having an aliform structure.

3. *Epidermella Lauri* (Fries) n. comb.

Hysterium Lauri Fries, Linnaea 5 : 552. 1830.
Hypoderma Lauri Duby, Mém. Soc. Phys. et Hist. Nat. Genève 16 : 55. 1861.
Lophodermium Lauri Rehm, Rabenhorst's Kryptogamen-Flora 3 : 37. 1887.

Hysterothecia gray or dull black, amphigenous in light stramineous spots of variable extent which are sharply delimited by black, stromatic lines, narrowly oblong with rounded ends, 720-3500 μ long, 350-475 μ wide, simple or confluent end-to-end or appearing branched because of lateral confluences, subcuticular. Labia fine and narrow, 15–20 μ wide, only slightly carbonized, reaching to within 200 μ of each end of the

hysterothecium, lined inwardly by a white mass of hyaline, clavately expanded, gelatinous and soon evanescent periphyses 10–20 μ long by 1–1.5 μ wide. Basal layer a brown, translucent plate of radiately disposed aliform prosenchyma; this overlaid to a depth of 10 μ by a finely interwoven, hyaline plectenchyma from which the hymenium arises. Cover well arched, brown and more or less translucent, consisting of an outer plate of heavily chytinized, radiately disposed aliform hyphae and 2-5 layers of slightly carbonized pseudocollenchyma. Paraphyses filiform, hyaline, nonseptate, simple, not clavately expanded but more or less crushed or bent by pressure and gelatinously fused above the asci to form a white epithecium up to 20 μ thick, 80-100 μ long by about 1 μ wide. Asci clavate to fusiform, rounded above, tapered below to a long thin stipe, 70–80 μ long, 6–10 μ wide, 8-spored. Ascospores cylindrical, hyaline, nonseptate in the ascus, more or less fasciculate and tending to be arranged in pairs in the expanded upper portion of the ascus, 18–30 μ long, 1–1.5 μ wide, incased in a hyaline gelatinous matrix 1–1.5 μ thick.

Imperfect stage: Unknown.

Type locality: Not given by Fries.

Type specimen: Not cited by Fries. The description above is written from de Thuemen's Mycotheca universalis No. 1464.

Host: *Laurus nobilis*: Austria (Jaap, 1916), France (Duby, 1861), Italy (Rabenhorst, exs.), Spain (Duby, 1861).

Exsiccati: Jaap, Fungi sel. exs. No. 559; Rabenhorst, Fungi europ. Nos. 653, 1843; de Thuemen, Mycoth. univ. No. 1464.

Notes: There are two types of mycelium produced by this fungus. One is subcuticular, brown, distantly septate, 3–3.5 μ wide, with a tendency to follow the lateral walls of the epidermal cells and to form, thereby, a loose, subcuticular, extensive network. The other is internal, hyaline, 1–1.5 μ wide and tends to ramify through the host tissues and to collect as a loose subiculum about the base of the hysterothecium.

Duby (1861) considered this a species referrable to his genus Hypoderma, but Rehm (1887) transferred it to Lophodermium, on the basis that the ascospores are acicular and one-celled, though he noted that so far as the ascus shape is concerned it might well be a Hypoderma. Darker, (1932, p. 15) has defined Hypoderma in his key as having one-celled spores, though his figures (pl. 7, figs. 3, 4, 5, 8; pl. 8, fig. 3; pl. 9, fig. 6) indicate that, at least at the time of germination, the spores of pinicole species become two-celled. Partly on the basis of spore length, partly on the basis of spores being or becoming 2-celled in the ascus, he has segregated (*l. c.*, p. 62) *Hypoderma deformans* Weir in a new genus, Elytroderma. A comparison of Rehm's figures of *Hypoderma Rubi* (1887, p. 29, figs. 1–7), as well as examination of other extant material,

indicates that Darker's Elytroderma is more nearly in accord with Hypoderma than are the several pinicole species of Hypoderma recognized by Darker.

The exact definition of Hypoderma rests, however, on the description and figures given by de Notaris (1847), for which the type is *H. Rubi.* Rehm appears to have been right in excluding *H. Lauri;* but his placement of it in Lophodermium is incorrect.

Its position is subcuticular, with relation to its host tissues, and the definitely radiate construction, the presence of aliform mycelium, the separate development of the hysterothecial base and cover, and the presence of periphyses within the ostiole appear to justify the segregation of it in a new genus, along with other similar species.

In the same category belongs the *Hypoderma virgultorum* DC. on the petioles of fallen leaves of Ailanthus and of *Aralia spinosa* distributed in Ellis and Everhart's North American Fungi No. 2378.

4. LOCELLIDERMA new genus

Genus of the Hypodermatacene. Ascomata in the form of hysterothecia, ellipitical to linear, opening by an elongated ostiole bordered by thickened, more or less carbonized labia and lined with gelatinizing, persistent or evanescent periphyses, divided internally into locules by the proliferation of imperfect cross-partitions of pseudoparenchyma from the basal layer, base and cover separate in origin as in maturity. Hymenium consisting of both asci and paraphyses, discontinuous. Paraphyses hyaline, filiform, simple, fused above the asci in an epithecium. Asci cylindrical, 8-spored. Ascospores elongate, 1-septate, hyaline, incased in a hyaline gelatinous matrix.

Locelliderma Ampelodesmi (de Cesati) n. comb.

Hypoderma Ampelodesmi de Cesati, Hedwigia 21 : 8. 1882 and Rabenhorst's Fungi Europaei et extraeuropaei exsiccati No. 2643b. 1881.

Hysterothecia dull to shining black, subepidermal, linear, 1-4 mm. long or by confluence becoming 10 mm. long, 250-500 μ wide, loculate within, divided on each side of the ostiole into subspherical chambers by dark brown, pseudoparenchymatous partitions, the locules 110-150 μ in diameter. Labia indefinite, narrow, carbonized, lined with very short, hyaline, evanescent periphyses. Basal layer a plate one to two cells thick, consisting of brown, translucent pseudoparenchyma; this overlaid to a depth of 15 μ by a closely interwoven, hyaline plectenchyma that is interrupted at the locule walls. Cover dark brown, hardly translucent, pseudoparenchymatous, involving the epidermal cells. Paraphyses hyaline,

filamentous, straight or flexuous, not clavately expanded but bent and crushed at the tips, exceeding the asci by 5-10 μ and gelatinously fused into a thin white epithecium, about 1 μ wide. Asci clavate to subcylindrical or saccate; bluntly rounded above, tapered to a short or long, fine stipe, 65-90 μ long, 12-15 μ wide, 8-spored. Ascospores hyaline, elongated, with rounded ends, straight or somewhat curved, 1-septate, the septum located 3-6 μ from one end and dividing the spore into 2 unequal cells, the spores arranged in 1 or 2 series, each inclosed in a hyaline, gelatinous matrix 2 μ thick, 20-24 μ long, 6.5-9 μ wide.

Imperfect form: Unknown.

Type locality: "Neapolitano, in H. B. (Catanensibus)."

Type specimen: Rabenhorst, Fungi europ. No. 2643b.

Host: *Ampelodesmus tenax:* Italy (Rabenhorst, exs.).

Note: It has seemed impossible to retain this species in Hypoderma, in view of the loculate condition of the hysterothecium and the special manner in which the ascospores are divided by the septum. The hysterothecium, in its loculate character, shows some relationship to the Phyllachoraceae, to which group it would undoubtedly be referred were it not for the fact that the entire "stroma" splits lengthwise in characteristic hysteriaceous fashion; and since it bears along this slit the periphyses characteristic of the Hypodermataceae, it has deserved the establishment of a genus on the basis of its characters.

In crushed preparations, the asci issue from the hysterothecia in subspherical bunches, conforming to the shape of the locules from which they are forced.

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PLATES

PLATE I

FIG. 1. Surface view of a typical hysterothecium, showing the general shape, the heavily carbonized labia surrounding the slit-like ostiole, the periphyses on the inner edges of the labia, the partially exposed hymenium, and dark hyphae in the epidermal cells of the host. (*Dermascia Festucae*, Rommeguère, Fungi. sel. exs. No. 7143.)

FIG. 2. Vertical, transverse section of a subepidermal hysterothecium, showing base, cover, subhymenial plectenchyma, hymenium, epithecium, carbonized labia, periphyses, and destruction and involvment of host cells. (*Lophodermium arundinaceum*, Sydow, Mycoth. Germ. No. 1172.)

FIG. 3. Vertical, transverse section of an immature intraepidermal hysterothecium, showing plectenchymatic base, carbonized cover, and thickened labia, noncarbonized cells of the "slit band," hymenium, and relation to host tissues. (*Lophodermellina pinastri* on Picea, Rommeguère, Fungi Gall. exs. No. 1661.)

FIG. 4. Median vertical, transverse section of a subcuticular hysterothecium, showing base, cover, carbonized labia, periphyses, hymenium, subhymenial plectenchyma, and relation to host tissues. (*Lophodermina maculare*, de Thuemen, Mycoth. univ. No. 75.)

FIG. 5. Vertical, transverse section near one end of a subcuticular hysterothecium, showing the labia and periphyses as structures distinct from the base and hymenium. (*Lophodermina maculare*, de Thuemen, Mycoth. univ. No. 75.)

FIG. 6. An ascus and paraphyses, showing the general shape of the ascus, the arrangement of the filiform spores in fascicle and in pairs, and filamentous paraphyses with clavately expanded tips. (*Lophodermina juniperina*, Sydow, Mycoth. Germ. No. 1600.)

FIG. 7. Distal portion of an ascus, showing the asymmetrically conical apex, the arrangement of spores in pairs, and the tendency of the spores to become coiled. (*Lophodermium arundinaceum*, Sydow, Mycoth. Germ. No. 1598.)

FIG. 8. Vertical section through the cover of a subcuticular hysterothecium, showing the cuticle of the host (a), the outer, aliform plate with the lateral walls of the cells cutinized (b), and the inner pseudocollenchyma (c). (*Lophodermina maculare*, de Thuemen, Mycoth. univ. No. 75.)

FIG. 9. Meandering aliform mycelium from the aliform cover of a subcuticular hysterothecium. (*Lophodermina autumnale*, type specimen.)

FIG. 10. Diagrammatic vertical, longitudinal section through a subepidermal hysterothecium showing the lack of continuity between the base and cover at the ends of the hysterothecium. (*Lophodermium arundinaceum*, Mougeot & Nestler, Stirp. Crypt. No. 655.)

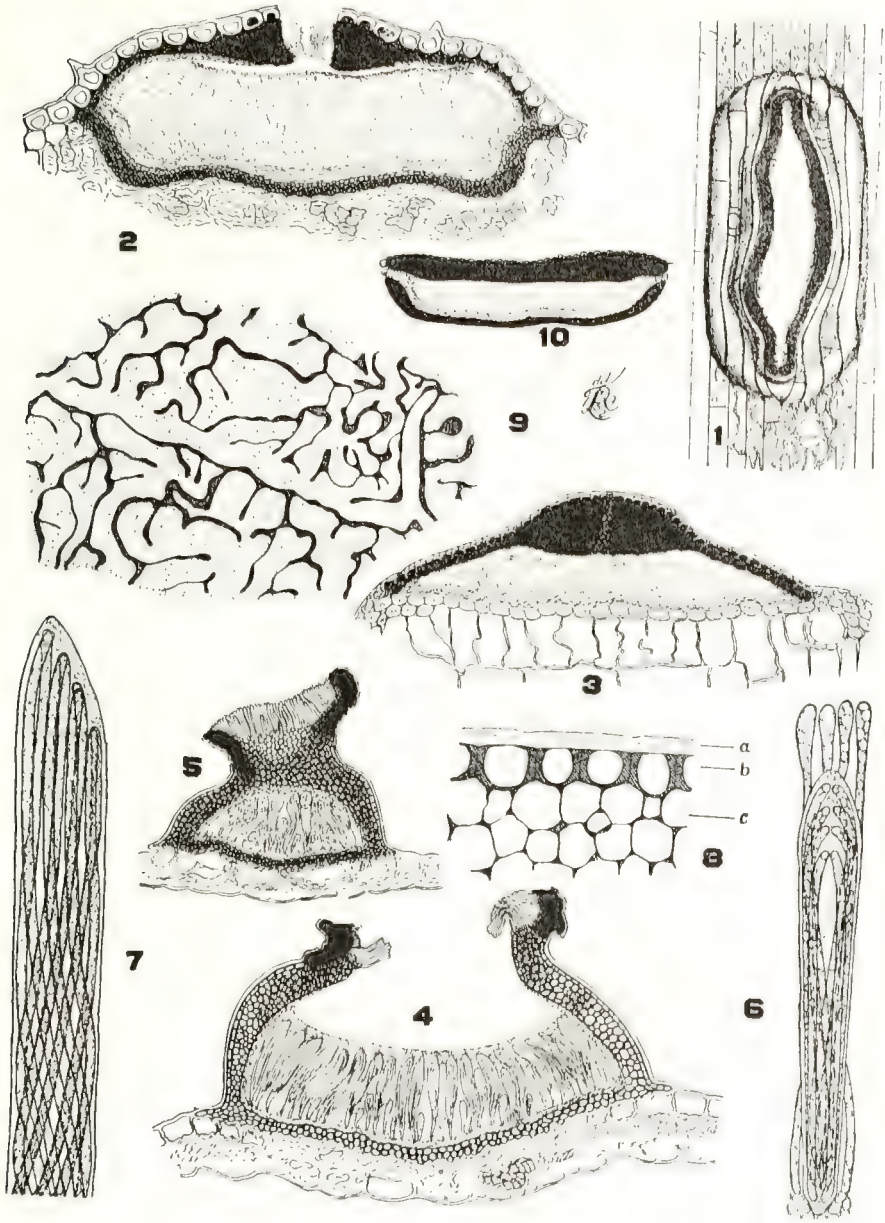

PLATE I

PLATE II

FIG. 1.—Vertical, transverse section through the slit region of a subepidermal hysterothecium, showing the involvement of epidermal cells, the pseudocollenchyma of the cover, the heavily carbonized labia, and the periphyses lining the slit. (*Lophodermium arundinaceum,* Sydow, Mycoth. Germ. No. 1173.)

FIG. 2.—Transverse section of a stoma in an infected leaf of Picea, showing the substomatal stromatic aggregation of fungous cells commonly produced by pinicole species. (*Lophodermellina pinastri,* Roumeguère, Fungi Gall. exs. No. 1661.)

FIG. 3.—Transverse section, through the epidermis, of a leaf of Picea, showing part of the margin of a hysterothecium of *Lophodermellina pinastri.* The two layers of hyphae in the epidermal cells are shown, as is also the manner in which the layers are separated by means of elongated "prop" cells. (Roumeguère, Fungi Gall. exs. No. 1661.)

FIG. 4.—Vertical, transverse section through the margin of a subcuticular hysterothecium, showing (a) the host cuticle, (b) the outer, aliform plate, (c) pseudocollenchymatous cells of the cover, (d) pseudoparenchymatous cells of the cover, (e) pseudoparenchymatic cells of the base, (f) marginal cover cells, (g) hyaline, extra-hysterothecial subicle, and (h) epidermal cells of the host. (*Lophodermina maculare,* de Thuemen, Mycoth. univ. No. 75.)

FIG. 5.—Extra-hysterothecial mycelium of a subepidermal species. The hyphae emanate from the ends of the hysterothecial covers and penetrate the interiors of epidermal cells of the host, where they form a conspicuous network extending some distance from the hysterothecium. (*Lophodermium Dactylis,* Roumeguère, Fungi Gall. exs. No. 1700.)

FIG. 6.—Aliform mycelium from the margin of a subcuticular hysterothecium, showing the indentions in the apical cells which result in dichotomous branching. (*Lophodermina juniperina,* Sydow, Mycoth. Germ. No. 1600.)

FIG. 7.—Aliform mycelium from the margin of a subcuticular hysterothecium, showing the multiple branching of hyphal apices. (*Lophodermina Thuyae,* Davis, Fungi Wisc. exs. No. 114.)

FIG. 8.—Extra-hysterothecial mycelium of a subepidermal species, showing the sympodial branching resulting from the indention, in an aliform manner, of enlarged apical cells of hyphae occupying lumens of epidermal cells of the host. (*Lophodermium Miscanthi,* Baker, Fungi Malayana No. 155.)

FIG. 9.—Habitat sketches of *Lophodermium arundinaceum* on *Phragmites communis.* (a, b. de Thuemen, Mycoth. univ. No. 77; c. Sydow, Mycoth. Germ. No. 1598.)

Fig. 10.—Hysterothecia of *Lophodermium arundinaceum,* much enlarged, on *Phragmites communis.* (de Thuemen, Mycoth. univ. No. 77.)

FIG. 11.—The top of an ascus of *Lophodermium arundinaceum,* showing the acute apex, the pairing of the spores, and the tendency of the spores to become coiled. (Sydow, Mycoth. Germ. No. 1598.)

FIG. 12.—*Lophodermium Brachypodii:* a, habitat sketch; b, c, lateral and top views of a hysterothecium with reflected light; d, hysterothecium by transmitted light. (Migula, Crypt. Germ., Aust. et Helv. exs. No. 240.)

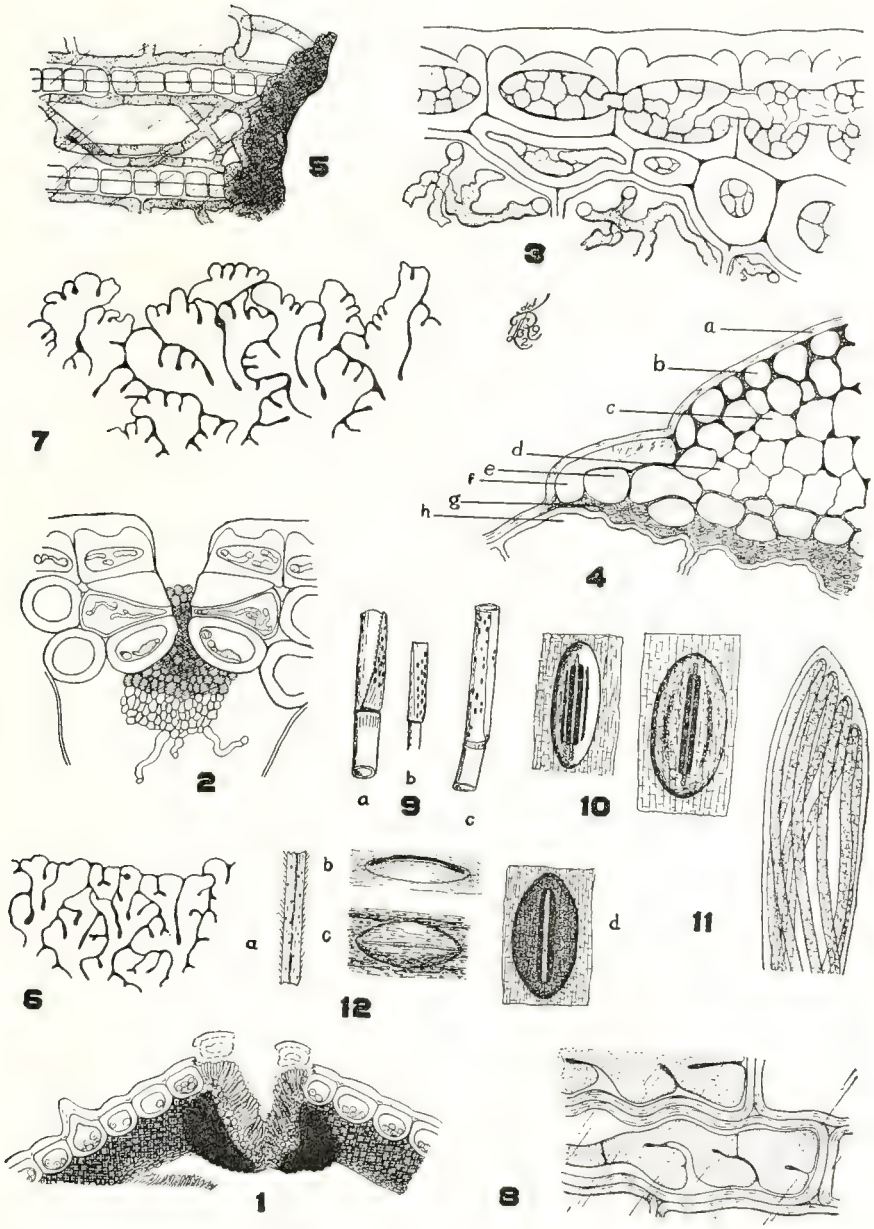

PLATE II

PLATE III

FIG. 1.—*Lophodermium Miscanthi:* Habitat sketch, linear hysterothecium, and ascus with paraphysis. (Baker, Fungi Malayana, No. 155.)

FIG. 2.—*Lophodermium Phlei:* ascus, spores and paraphyses. (Ellis, N. Amer. Fungi. No. 465.)

FIG. 3.—Hysterium of *Dermascia Festucae.* (Roumeguère, Fungi sel. exs. No. 7143.)

FIG. 4.—*Dermascia Festucae:* (a) hysterothecium and (b) tip of an ascus showing coiling of the spores. (Roumeguère, Fungi sel. exs. No. 7143.)

FIG. 5.—*Dermascia latispora:* (a) surface view of a hysterothecium, and (b) the peculiar, subaliform mycelium constituting the outer plate of the hysterothecial cover. (Rehm, Ascomyceten No. 775.)

FIG. 6.—*Dermascia latispora:* ascus, spores, and paraphyses. (Rehm, Ascomyceten No. 775.)

FIG. 7.—*Lophodermellina macrospora:* habitat sketch on a needle of Picea, and ascus and spores (Kunze, Fungi sel. exs. No. 374.)

FIG. 8.—*Lophodermellina Passiflorae,* showing the intraepidermal aliform hyphae of the hysterothecial margin. (Baker, Fungi Malayana No. 38.)

FIG. 9.—*Lophodermellina pinastri:* ascus, spores, and paraphyses. (Roumeguère, Fungi Gall. exs. No. 1661.)

FIG. 10.—*Lophodermellina pinastri:* two habitat sketches showing shape and location of hysterothecia, and the stromatic separations between infections. (Roumeguère, Fungi Gall. exs. No. 1661.)

FIG. 11.—*Lophodermellina pinastri:* aliform hyphae from the margin of the hysterothecial cover. (Roumeguère, Fungi Gall. exs. No. 1661.)

FIG. 12.—*Lophodermellina Rhododendri:* intraepidermal aliform mycelium constituting the margin of a hysterothecium. (Ellis and Everhart, Fungi Columb. No. 738.)

FIG. 13.—*Lophodermellina Tritici:* habitat sketch, hysterothecia enlarged, ascus with spores, and clavately enlarged parapysis tip. (Roumeguère, Fungi sel. exs. No. 6144.)

FIG. 14.—*Lophodermina juniperina:* habitat sketches, natural size and enlarged, on *Juniperus communis.* (de Thuemen, Mycoth. univ. No. 76; Sydow, Mycoth. Germ. No. 1600.)

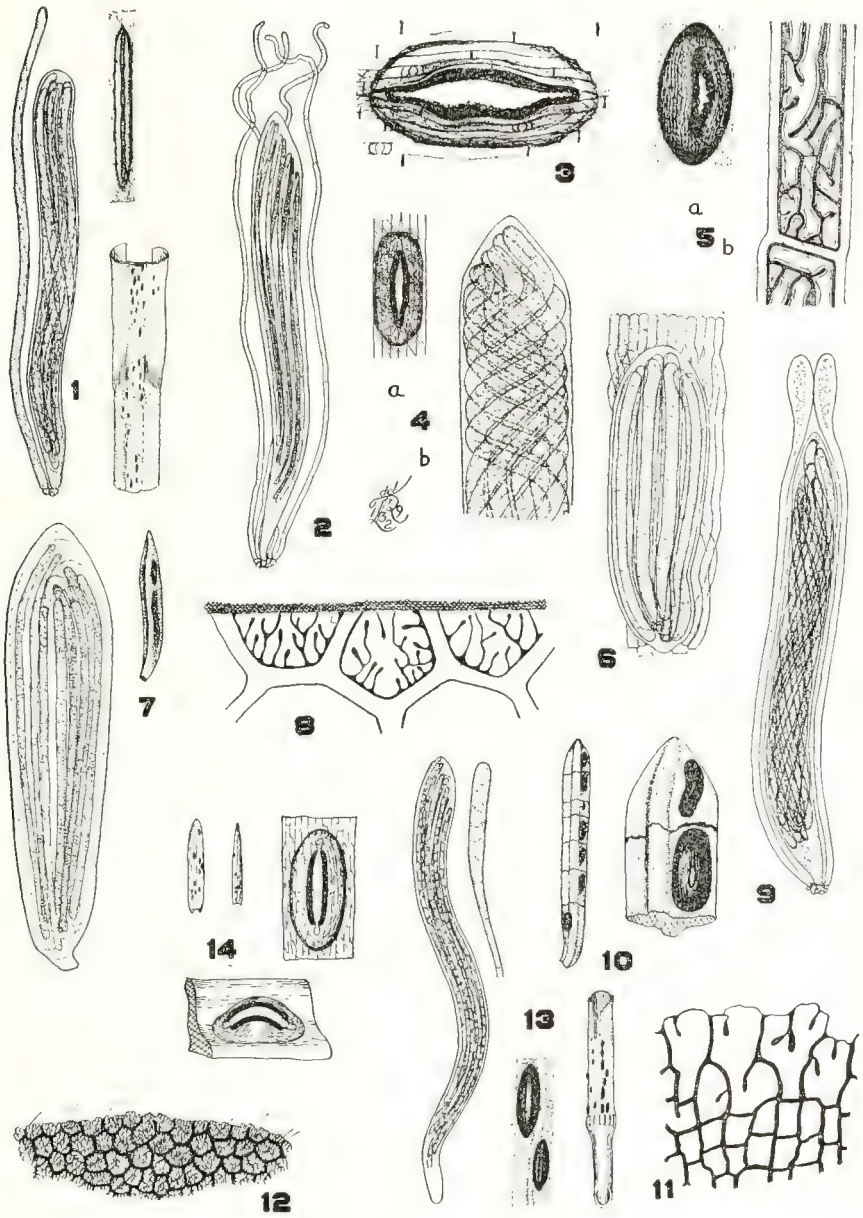

PLATE III

PLATE IV

FIG. 1.—*Lophodermina culmigena:* habitat sketch on *Aira flexuosa,* hysterothecium, and ascus with spores and paraphyses. (Sydow, Mycoth. Germ. No. 1599.)

FIG. 2.—Aliform, meandering mycelium from the cover plate of *Lophodermina culmigena.* (Sydow, Mycoth. Germ. No. 1599.)

FIG. 3.—Aliform hyphal tips from the margin of the hysterothecial cover of *Lophodermina culmigena.* (Sydow, Mycoth. Germ. No. 1599.)

FIG. 4.—Ascogonial cells above the basal plate of a young hysterothecium of *Lophodermina culmigena.* (Sydow, Mycoth. Germ. No. 1599.)

FIG. 5.—*Lophodermina juniperina:* old, empty hysterothecium enlarged, showing subcuticular position and regions of carbonization. (Sydow, Mycoth. Germ. No. 1600.)

FIG. 6.—Dichotomous aliform mycelium from the cover plate of *Lophodermina juniperina.* (Sydow, Mycoth. Germ. No. 1600.)

FIG. 7.—*Lophodermina apiculata:* hysterothecium, enlarged, and ascus with spores and paraphyses. (Kunze, Fungi. sel. exs. No. 372.)

FIG. 8.—*Lophodermina macularis* epiphyllous on *Vaccinium uliginosum:* habitat sketch, hysterothecium enlarged, and aliform hyphal ends from the hysterothecial margin. (Roumeguère, Fungi Gall. exs. No. 553.)

FIG. 9.—*Lophodermina macularis* hypophyllous on *Vaccinium pennsylvanicum:* habitat sketch, hysterothecium enlarged, and aliform hyphal ends from the hysterothecial margin. (de Thuemen, Mycoth. univ. No. 75.)

FIG. 10.—*Lophodermina macularis* hyphophyllous on *Vaccinium uligniosum:* habitat sketch, vertical and lateral views of a hysterothecium enlarged, and aliform cells from the hysterothecial margin. (Sydow, Mycoth. Germ. No. 2146.)

FIG. 11.—*Lophodermina macularis* on "Quaking Ash": habitat sketch, hysterothecium enlarged, and aliform mycelium from the hysterothecial margin. (Ellis, N. Amer. Fungi No. 859.)

FIG. 12—*Lophodermium pinicolum* on *Pinus sylvestris:* distribution of hysterothecia on a needle and separation of individual infections by black, stromatic lines. (Kunze, Fungi sel. exs. No. 371.)

FIG. 13.—*Lophodermina Aleuritis:* habitat sketches, natural size and enlarged. (Baker, Fungi Malayana No. 154.)

FIG. 14.—*Lophodermina Aleuritis:* ascus and spores. (Baker, Fungi Malayana No. 154.)

FIG. 15.—*Lophodermina Aleuritis:* hysterothecium, enlarged showing the extensive subcuticular skirt formed by the aliform mycelium of the hysterothecial cover. (Baker, Fungi Malayana No. 154.)

FIG. 16—*Lophodermium arundinaceum* on *Phragmites communis:* habitat sketch on a leaf sheath, lateral view of a hysterothecium, enlarged, and the tip of an ascus, showing the acute end of the ascus and the tendency of the ascospores to become intricately coiled in the ascus. (Sydow, Mycoth. Germ. No. 1172.)

FIG. 17.—*Lophodermium arundinaceum* on *Phragmites communis:* surface view of a hysterothecium, enlarged, showing the shape of the hysterothecium, its relation to the host epidermis, the shape of the ostiole and of the carbonized labia. (Sydow, Mycoth. Germ. No. 1172.)

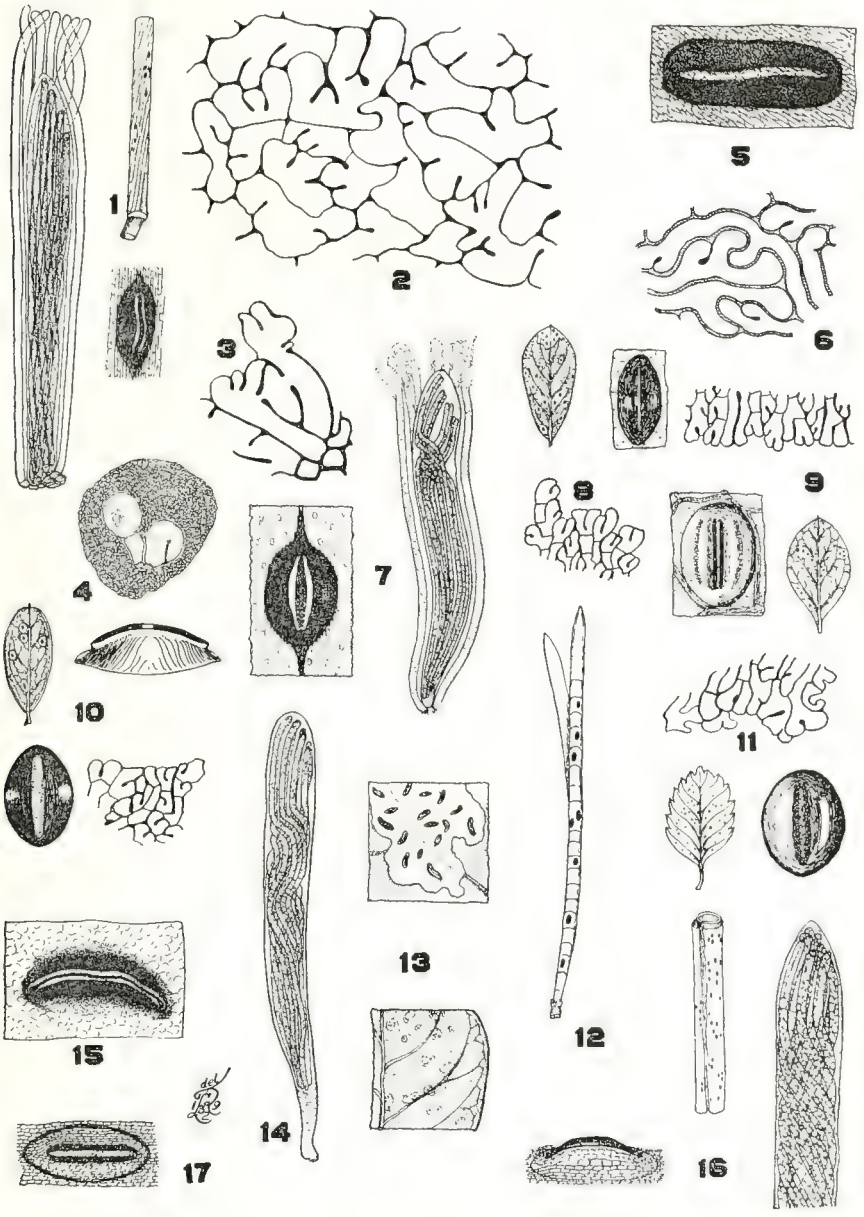

PLATE IV

PLATE V

Type specimen packets of Spegazzinian species of Lophodermium. In his characteristically careful manner, Spegazzini has indicated on the outside of each packet, with notes and drawings, the characters of the hysterothecia and of the asci, paraphyses, and ascospores.

The species illustrated are: 1, *Lophodermium leptothecium;* 2, *L. oxyascum;* 3, *L. subtropicale;* 4, *L. antarcticum;* 5, *L. fuegianum;* 6, *L. clavuligerum.*

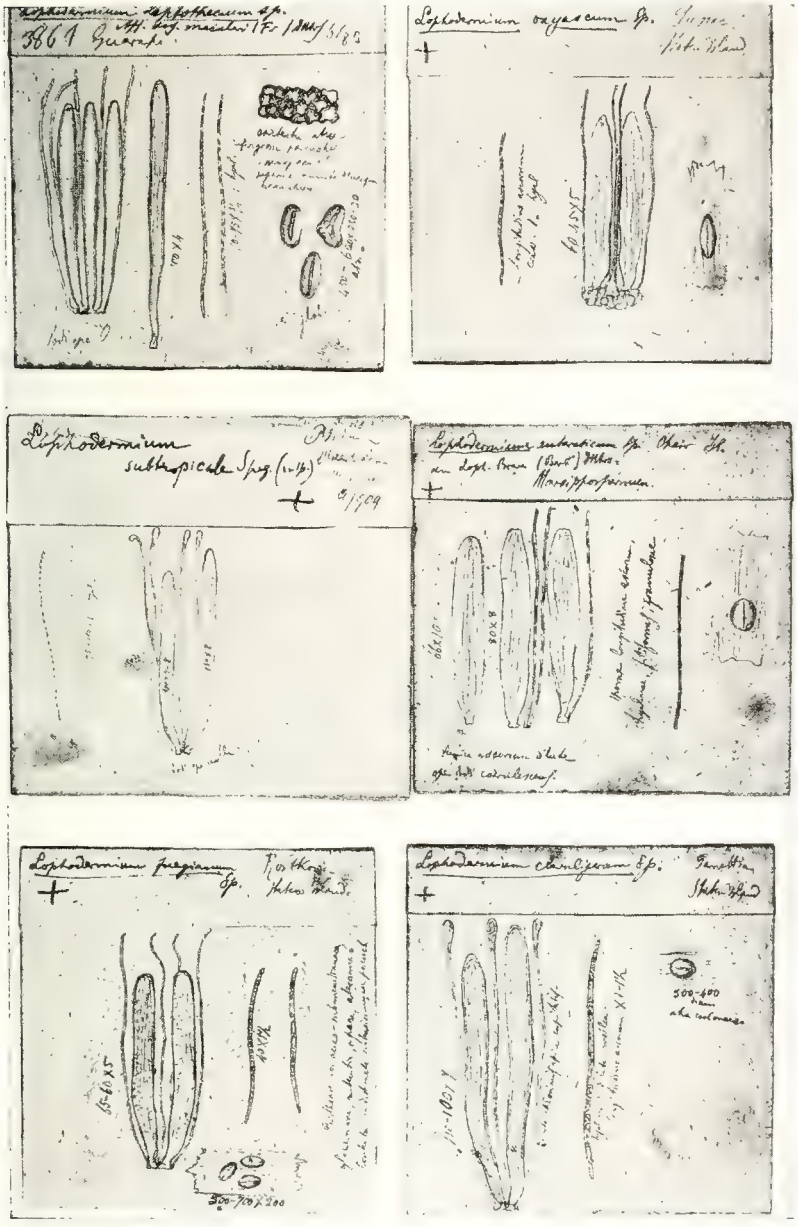

PLATE V

LIBRARY
OF THE

HOST LIST

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BY

LEO ROY TEHON

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